THE IRON TRADE REVIEW

VOLUME XXVII. CLEVELAND, O. OCTOBER 4, 1894. CHICAGO, ILL. NUMBER 40

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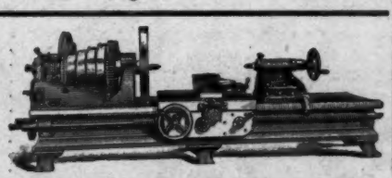

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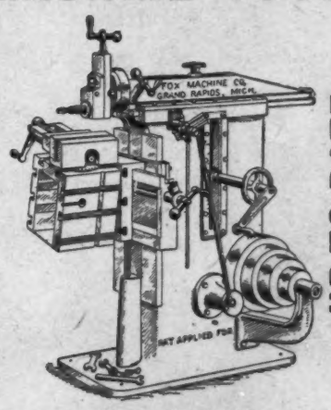

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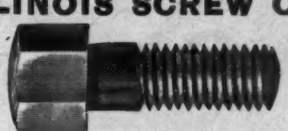

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75 "	40	"	"	"	"	"
180 "	52	"	"	"	"	"
200 "	60	"	"	"	"	"

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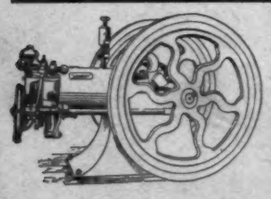

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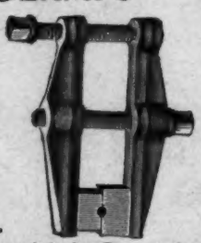

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THE IRON TRADE REVIEW

VOLUME XXVII. CLEVELAND, O. OCTOBER 4, 1894. CHICAGO, ILL. NUMBER 40.

THE WEEK IN IRON CIRCLES.

GENERAL FEATURES.

The most important development of the week in iron and steel is the announcement of the transplanting to the United States of the Otto-Hoffman system of coke making, with by-product recovery, and the decision to erect the first plant at Johnstown, Pa. This step is significant of the determination of the steel masters of this country to be armed with every economy against all competition that new conditions may bring from without. The course of the market in the week under review has brought more surface indications of a letting down from the activity of later August and early September. But there are other considerations than the passing phases developing week by week that must be regarded in making up a judgment as to the future. The accumulation of demands for material, from a multitude of sources, few calling for any large amount, is not to be mistaken for the pace which recovering business is to take on. Nor is a letting down from the scale of production which these accumulated demands made necessary for a time, to be taken as a sign of arrested recovery. The great sources of strength to the iron and steel market are yet to be heard from and they may come into line with any month. In spite of the evidences of weakness that crop out here and there, many furnaces report engagements for months ahead, and along with the additions to the list of producers there is a limit to the amount of spot iron offered and no indication of an accumulation of stocks. Yet the month of September brought a decline of 65 cents in Bessemer iron, and of about 50 cents on some grades of foundry iron. Sales of the latter in the past week have brought out low prices, and Lake Superior charcoal has broken its record again, a Central New York agricultural contract being taken at $12.50, Buffalo. Pittsburg advices tell of limited sales of Bessemer at $11, with buyers making lower offers and announcing their ability to shade this figure. Billets are weaker and the range of Pittsburg transactions is $16@$16.50, with the amount of spot material still limited. In finished material there have been few large deals in any selling center the past week. Bridge material is still the most prominent factor in going business. Wrought pipe makers, also, have made some good sales. The notice of a new wage adjustment Jan. 1, by the leading Pittsburg producer is not construed as favorable to the men nor as an indication that Pittsburg is to be less aggressive, the coming winter, in markets east and west. There are evidences that the producers of Connellsville coke intend to get out of the desperately low rut in which coke prices have gone the past year. No contracts now in force run beyond Jan. 1 and a higher price is looked for after that date. A good many old $1 and $1.10 contracts have been pieced along through the fall months and the 30-day and 60-day contracts at higher figures have not long to run.

THE CLEVELAND OUTLOOK.

The firm lake freights of September did not prevent the bringing down of a large amount of ore—a fair share of it on wild charters—from Lake Superior ports. Soo canal returns show that shipments from Duluth, Two Harbors, Ashland and Marquette in September were 928,954 gross tons, making a total for those ports to Oct. 1 of 4,685,109 gross tons. Up to Aug. 18 Escanaba shipments were 918,592 tons. Estimating the Escanaba shipments since Aug. 18 and the Gladstone shipments, which began in the latter part of August, at 300,000 tons, would make the total from all ports to Oct. 1, 5,903,701 gross tons. It need not be expected that shipments from this time out will be on any scale approaching that of September. Gogebic range shippers are already getting toward the end. But it will require a much more conservative policy than Mesabi shippers have shown of late, to hold the total down to the 6,500,000-ton mark.

Pig Iron. A 3,000-ton sale of Bessemer iron at $10.35 Valley furnace, or $11 Pittsburg, was made the past week, and the transaction is probably a fair gauge of the market on that metal. It is agreed that there is no great amount of spot Bessemer offering and it would not be easy to go into the market and pick up 10,000 tons for immediate delivery. The operations of some furnaces, owing largely to trouble with coke, did not result in as large an output of standard Bessemer as was to be expected in the first half of September, but this difficulty is now largely corrected. Inquiries for Bessemer are comparatively few, the large consumers being still supplied on old contracts. Foundry irons are weaker and yet in a few cases furnaces usually making for the foundry trade are on Bessemer, and others are sold for several months ahead. Lake Superior charcoal iron has touched the lowest point yet, a round lot selling at $12.50 Buffalo. Yet a 600-ton sale for car-wheel purposes is reported at a price considerably higher, indeed much higher than the market has been for months.

Finished Material. A bridge contract calling for 1,100 tons of material is about to be let in Cleveland. The bridge company bids range about $120,000, while a firm of contractors bids $94,000. There may be a legal squabble over a proviso in the specifications that bidders must own bridge works. In general the week has shown a falling off in demand. Prices are weak, though in structural material there is no quotable difference. Bar iron still grovels, and with old material ranging from $1 to $2 a ton higher, there is some surprise that bars should be steadily lower. Demand has been good for both black and galvanized sheets, and the closing down of many black plate mills has made prices somewhat firmer.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

The week has been in some respects a little better than the one preceding, although in other directions there is no improvement perceptible. Crude material sold well, and bridge shapes were in good demand. Aside from this sales were mostly for small lots of all kinds of iron and steel.

PIG IRON.—Good sales of local iron were made last week, among them several lots of 1,000 tons, several of from 500 to 700 tons, and a good run of smaller orders, making an excellent aggregate—somewhat larger than that of the week previous. Prices appear to be stiffening a little, and while there has hardly been an actual advance, at least one of the furnaces has been able to secure better prices than have ruled lately. Southern iron has been very quiet, with only a few small sales of softeners and silveries. Prices are maintained fairly well, but charges are heard that some cutting is being done. Several fair lots of Ohio silveries were sold in this market last week at current quotations. Lake Superior charcoal is quiet, with only a car load trade going. Our quotations are made as follows:

Lake Sup. Charcoal	$14 75@15 25	South'n Silveries No. 1.	$12 00@12 25
Local Coke Fdy. No. 1	10 25@10 50	South'n Silveries No. 2.	11 50@11 75
Local Coke Fdy. No. 2	10 00@10 25	Jackson Co. Silveries	14 50@15 00
Local Coke Fdy. No. 3	9 50@10 00	Ohio Silveries No. 1	14 00@14 50
Local Scotch Fdy. No. 1.	10 75@11 00	Ohio Silveries No. 2	13 00@13 50
Local Scotch Fdy. No. 2.	10 00@10 50	Ohio Strong Softeners	13 00@13 50
Local Scotch Fdy. No. 3.	9 50@10 00	Alabama Car Wheel	17 75@18 25
South'n Coke No. 1	11 75@12 00	South'n Charcoal No. 1.	15 50
South'n Coke No. 2	11 00@11 25	South'n Charcoal No 2	14 50
South'n Coke No. 3	10 50@10 75	South'n Charcoal No. 3.	14 00
Southern No. 1 Soft	10 75@11 00	Malleable Bessemer	10 75@11 25
Southern No. 2 Soft	10 50@10 75	Coke Bessemer	11 25@11 50

BARS.—One order of 500 tons for a car works was taken last week, and there is a fair demand for car iron in small lots. General trade is quiet, with only an inquiry and orders for small amounts. Prices are still quoted at 1.05c. to 1.10c. on common iron, but sales have been made at lower figures. Bar steel is in fair demand at 1.25c to 1.30c, guaranteed iron at 1.10c. to 1.20c.

STRUCTURAL MATERIAL.—Orders for two or three of the bridges to be used over streets in the track elevation plans were given last week, Pittsburg getting the material. Contracts for others of these bridges will be let in the near future, and it is probable that they will be coming up from time to time until all the tracks are elevated. Aside from this work business is quiet, and in building shapes almost nothing is being done. Prices are unchanged as follows: Beams, 1.45c; plates, 1.45c; angles, 1.40c. to 1.45c; tees, 1.65c to 1.70c. Small lots from stock are quoted at ¼c to ½c higher.

RAILS AND TRACK SUPPLIES.—Only a few small orders were taken for standard sections, but a fairly good trade was secured in light rails for street railway purposes. Prices are unchanged. Rails $25 to $27; splice bars, 1.25c to 1.30c; track bolts, 2.10c. to 2.20c; spikes, 1.70c. to 1.75c.

BILLETS AND RODS.—A good tonnage was secured last week of both billets and rods—enough to run the local mills until November, at least—at prices last quoted, $17.50 to $18 for billets, $24.50 for rods.

PLATES.— Inquiry continues fair, and a good tonnage was closed last week, mostly in small lots. Quotations are unchanged. Tank steel, 1.40c to 1.50c; flange steel, 1.65c to 1.70c; firebox steel, 1.75c to 5c; boiler tubes, 70 and 75 per cent. discount.

MERCHANT STEEL.—Specifications come in freely, and a number of good orders were picked up last week. Prices are made as follows: Open hearth spring, tire and machinery steel, 1.75c to 1.80c; crucible spring, 3.50c; machinery, 4.50c to 4.75c; tool steel, 6½c and upwards.

SHEETS.—Black sheets are in excellent demand, but orders are nearly all for small lots. Prices are still made at 2.35c. to 2.40c. for iron, and 2.50c. for steel sheets. Galvanized sheets are selling quite well in small orders. Quotations are made at 75 and 10 and 5 per cent discount.

OLD RAILS AND WHEELS.—Old iron rails are being held by most owners at $11.25 to $11.50, although one buyer said he had a chance to purchase a lot of 700 tons at $11. Very few sales are being made. Old steel rails are quiet and unchanged at at $7.25 to $7.50 for short and $10.50 to $11 for long lengths. Old car wheels are in small demand at $10 to $10.50.

SCRAP.—The market is quiet with only sales and prices are unchanged. No. 1 forge, $9 to $9.50; No. 1 mill, $7; No. 1 machinery, $7.50; axles, $13 to $13.50; cast borings, $3 50 to $3.75; wrought turnings, $5 to $5.25; axle turnings, $6.50 to $6.75; mixed steel, $5.50; heavy cast, $7 to $7.50.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The market here has shown one or two rather anamolous features within the week. With very little spot steel offering there has been a further weakening in price and October billets have sold at $16.25. The same weakness has been apparent in Bessemer pig, and some spot transactions at $11 have taken place, but there is only a limited amount of prompt Bessemer available. A large output of coke is being made and there is more pressure to dispose of it, but no contracts are made beyond Jan. 1. The indications are that coke producers are getting ready for an advance and there is little disposition among furnacemen to oppose it. The coke question is an important element in the future course of the pig iron market. In foundry irons there has been a slight decline in price, yet furnaces are getting fairly well sold for the balance of the year. Gray forge is easier, owing to increased production, and $9.75 is the ruling figure on prompt orders. The mills are nearly all running full, but on old contracts and the volume of new business is only fair. Beams and channels are quoted 1.25c.@1.30c. up to 15 inches wide; tank plates at 1.20c.; wire rods at $23.50; old iron rails at $13, old steel rails $10. Black sheets have been in good demand. Bar iron shows no recovery and .90c. on large lots has been done and a shade lower.

Cincinnati. There is a good deal of talk of lower prices impending on account of the increase of output by the furnaces. It should be borne in mind that considerable of the increase reported in active furnace capacity comes from furnaces making Bessemer iron, and only in small proportion from those making foundry and mill irons for the general market. Furthermore, there is no evidence that the improved demand has run its course and is slacking off. The contrary is the fact up to this writing. Nearly all foundries are doing a little more than they were a month or six weeks ago, and an addition of one heat a week on an average with 4,000 foundries, which is perhaps a conservative estimate, means an increase of about 20 per cent. in actual consumption. Furnace men from their standpoint claim that well filled order books, decreasing stocks and a continuous demand are not good reasons for making concessions in prices. While there is the old urgency to secure a share of current business, nearly all furnaces have booked large or-

ders, many of them sufficient to take the entire product for months ahead. The orders booked the past week include several of 1,000 tons each, and a large number ranging down all the way to carload lots. The reappearance of some demand from the cars works is an encouraging sign, this class of trade having been practically dead for eight months. There is also a moderate inquiry for mill iron for puddling. So far as can be seen, there is no disposition to speculative buying, nor to stock up because iron is cheap. Purchases are apparently to cover actual requirements.

St. Louis. The pig iron market has shown little activity this week, and a few orders are reported having been placed a shade under prices maintained by the leading standard irons in the Birmingham district. One contract for a round lot of Lake Superior charcoal iron was closed this week at the lowest price recorded. Consumers are still urging shippers to forward iron rapidly on existing contracts and the Southern furnaces are catching up on their orders for soft grades.

Buffalo. The demand for iron in the territory tributary to this market continues in a surprising manner. Consumption is undoubtedly increasing and is nearly, if not quite, on a par with production. Inquiries are numerous and well distributed and each inquiry means a sale for some furnace, as there is no evidence of speculation in the market.

THE Totten & Hogg Iron & Steel Foundry Co., of Pittsburg, manufacturers of tin plate, rolling mill, and special machinery and engines, have lately closed a contract with the Griswold Linseed Oil Co., of Warren, O., for four machines for crushing seed. Each machine consists of five 16x60″ chill rolls, placed one above the other, and complete with housings, bed plates, etc. They have also received a fifth order from the Irondale Steel & Iron Co., Middletown, Indiana, for two 100 horse power boilers, and orders for a number of rolls from the American Tin Plate Co., Elwood, Ind., and the Wright Shovel Co., of Anderson, Ind.

THE Spicer Mfg. Co., New Philadelphia, O., made a shipment on the 24th ult. of three car loads of rolling mill machinery to the Whittaker Iron Co., Wheeling, W. Va., to be placed in its new mill. The same company also reports making a shipment to the Cleveland Rolling Mill Co., Cleveland, O., of one of their nail cleaner barrels with hopper complete. This barrel is of 20-keg capacity and is therefore a great saving over the small cast barrel commonly used in nail cleaning.

PREPARATIONS are now being made to remove the various works of the Westinghouse Electric & Mfg. Co., of Pittsburg, to the new plant of the company at Brinton, Pa., and the removal of part of the old plants will be commenced within the next thirty days. The plant in Allegheny will be the first to be removed. Following this the plant in Newark, N. J., will be removed and then the plant in Pittsburg.

ARTICLES of incorporation have been filed in Des Moines, Ia., by the Goodwin Car Co., of that place, with an authorized capital stock of $2,000,000. The directors of the company are John M. Goodwin, president; H. T. Tate, secretary; Alexander Mason, treasurer, Albert T. Otto, Robert A. Kramer, E. W. Goodwin and George Richter. The business of the company is stated to be the manufacture of cars.

THE Secretary of War has formally approved the plans submitted by the Pennsylvania Railroad, for the proposed bridge across the Delaware River from Philadelphia to Camden, N. J., at a point one-fourth mile east from the Pennsylvania Railroad at Frankford Junction. The draw span will be 300 feet.

PART of the cargo of the schooner William Home, sunk last week soon after leaving Manistique, Mich., was 579 tons of charcoal iron shipped to Buffalo by the Weston Furnace Co.

STEEL WORKS IMPROVEMENTS.

The Cleveland Rolling Mill Co.'s plant at Newburg has been the scene of active construction and re-construction work, almost continually within the past year, and the plans of the company include still further improvements, some of them now under way and others to be taken up as fast as they can be reached with least interference with regular operations. All departments of the works have been running full for some time past with the exception of the plate mill. The new Bessemer steel mill completed early in the year has recently had its efficiency increased by the installation of an automatic twin blowing engine, the work of the Southwark Foundry & Machine Co., of Philadelphia. The dimensions of this engine are as follows: Steam cylinder, 44″; air cylinder, 60″; stroke, 60″. The flywheel weighs 30 tons. The engine has a positive inlet and automatic outlet air valve gear, and is so constructed that either side can be run independently of the other or both may be operated together.

The equipment of the Bessemer mill is modern in every particular. Four cupolas and one spiegel cupola prepare the metal for the two 10-ton converters. A Morgan traveling crane and complete hydraulic equipment, with a convenient arrangement of tracks for the handling of the metal and the changing of bottoms, leave nothing to be supplied that would secure rapidity and economy in the processes of conversion. The convertor bottoms are changed by the use of cars in trains of two. The one next the engine carries the new bottom and the other, which is pushed under the converter, takes the old botton on a plate hydraulically raised to receive it, and then by the same power lowered. The car with the new bottom then comes under the converter, another hydraulic connection is made, and the bottom is raised to its place. These changes are accomplished in remarkably short time.

When the work now under way at the open hearth plant is completed, the company will be prepared to furnish basic open hearth steel. Besides the erection of a basic furnace, the acid open hearth furnace will be replaced by a new one.

Hot metal has been successfully transferred from the Newburg furnace to the Bessemer mill, one-fourth mile distant, and it is the intention to bring hot metal on specially constructed ladle cars from the two Central furnaces, a distance of four miles. These furnaces have been doing excellent work of late. The stacks are 75x20 and their ordinary capacity is about 2,500 tons a week, but a recent record is 593 tons in 24 hours. Meantime Newburg furnace has been repaired and after relining and other improvements will be blown in again this week. That betterments involving the heavy expenditures made at the Cleveland Rolling Mill Co.'s property within the year should be completed without incurring any indebtedness tells its own story of solidity and of well husbanded resources. It need hardly be said that with advantages of location thus reinforced by modern equipment and special appliances, this company is better prepared than ever to meet the situation which the developments of the past 18 months have forced upon the steel masters of the country.

THE Inland Steel Co., which purchased the Chicago Steel Works plant at Chicago Heights, Ill., in October last year, have issued a catalogue of the bar steel and the agricultural shapes they manufacture—these including plow arches, cultivator arches, beams, channels, angles, tees, etc., with details of sizes and prices. Light steel T rails are also manufactured, ranging from 8 to 16 pounds per yard. The works have double the capacity of the old and machinery has been installed insuring the quick dispatch of orders.

THE Drexel Railway Supply Co., whose steel works are located on the belt line at East Chicago, Ill., send out a neat leaflet announcing that they are now making steel castings of all descriptions—car and locomotive castings, machine castings, gearing, sprockets and clutches, dies and die blocks.

ON 8,000,000 pounds of tin plate accumulated in bond at Baltimore in anticipation of the enforcement of the new duty Oct. 1, the loss to the government will be $80,000 in revenue. Most of the amount is to be taken out of bond at once.

THE IRON TRADE REVIEW

DEVOTED TO
IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES, IRON ORE PRODUCTION, TRANSPORTATION, AND GENERAL INDUSTRIAL PROGRESS.

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GERMAN COKE METHODS TRANSPLANTED.

The statement was made in these columns a short time ago, that the investigations pursued in the past two years, with a view to transplanting German methods of coke manufacture to the United States would soon eventuate in the erection in this country, of works after the German pattern. The Otto-Hoffman process of coke making, which includes the recovery of tar, sulphate of ammonia and benzole by the condensation of gases generated in the retorts, was referred to as the system most likely to be chosen. We are now able to state that arrangements have been completed for the erection of the first Otto-Hoffman plant in the United States. It will be built by the Cambria Iron Co. at their mines near Johnstown, Pa., and will be the regulation 60-oven plant with a capacity of about 70,000 tons of coke per year.

It need not be said to those who have been awake to the efforts quietly put forth on this line, that this is one of the most important developments for American blast furnace in years. If an era of still lower costs in American iron and steel is ahead, it is evident that a prime economy to be aimed at is in the item of fuel. Enough has been found out in the careful investigations of the gentlemen who have now transplated the Otto-Hoffman process to this side, to satisfy them that it ensures distinct economies in pig iron making.

Cleveland capital has had much to do with the preliminaries of the step referred to above; and it is largely due to the efforts of Cleveland gentlemen that the patents of the Otto-Hoffman process for North America were secured by the Otto Coke & Chemical Co., which was recently incorporated under the laws of West Virginia. The principal holdings in the new company are represented by the Cambria Iron Co. on the one hand, and the Mather interest, of Cleveland, on the other, this latter including Wm. G. Mather and Samuel Mather The investigations of Mr. Wm. G. Mather into the question began more than two years ago, and early last year, after gathering all the data available in the United States, Mr. Austin Farrell, of Negaunee, Mich., superintendent of the Cleveland Cliffs Iron Co.'s furnaces, went to Germany to collect material only obtainable there. Associated with Mr. Farrell was Dr. F. Schniewind, a Cleveland chemist, who some time before had obtained an option on the control of the Otto-Hoffman patents in certain portions of the United States.

The report made by Mr. Farrell was most exhaustive and it was emphatic as to the pre-eminence of the Otto-Hoffman and Otto-Coppee systems (the latter being the same as the Otto-Hoffman, but without by-product recovery) over any other system employing the retort oven. Its general use as against the limited use of the others was shown by a list of ovens in operation. From this list, with the later revisions made, it appears that there had been built up to July 1, 1894, 1,759 Otto-Hoffman ovens and 6,309 Otto-Coppee ovens (nearly all of them being in Germany), as against 492 Semet-Solvay ovens built or building in Belgium, France, England, Germany and the United States, 160 Carves-Seibel ovens in France, about 400 Simon-Carves ovens, and 100 Carves-Huessener. Of the mass of technical data which Mr. Farrell brought back, it is not our intention to speak here, since we are merely presenting the historical and commercial phases of the movement. It is enough for the present purpose to say that there were other trips to Europe and that early in the present year Mr. John F. Wilcox, of Pittsburg, and representatives of the Cambria Iron Co. became associated with the Cleveland investigators and 30 tons of Connellsville coal were taken across the Atlantic for tests in Otto-Hoffman plants in Westphalia. The coke made called forth the admiration of the German experts who examined it and there was left no doubt as to the successful coking of Connellsville coke in retort ovens. The tests showed that the process can be completed with a full charge in from 32 to 36 hours, and thus a much larger output is insured from a given number of ovens. Analyses were presented to the German experts, of Connellsville and Pocahontas coals and of Connellsville coals exposed for seven months on the Lehigh Coal Co.'s docks at West Superior, Wis. The experts in their report referred to the high yield of gas from the Connellsville coals, including that exposed at West Superior, and stated that, assuming that these American coals are similar to those of Westphalia, in not containing carbon hydrogens of the paraffine order, it might be concluded, from the illuminating power of the gas, as well as from the quality and quantity of the tar, that benzole is present in larger quantities than in Westphalia coal. Referring to the ability of retort oven coke to carry a blast furnace burden —the criticism in England being that it was inferior to coke from bee hive ovens in this particular—Mr. Farrell, after a careful observation of Westphalia blast furnace practice, makes this comment in his report: "If that is what they can do, the sooner American iron masters get such coke the better."

It is estimated, after careful computations, compared with actual practice with the Otto-Hoffman system in Westphalia, that from 100,000 tons of Connellsville coal that could be charged into 60 Otto-Hoffman retort ovens in a year, the yield would be about 70,000 tons, or 70 per cent. of coke. The yield of other products in the practice at a plant near Bochum, Westphalia, has been 1.18 per cent. of ammonia sulphate, equal to 1,180 tons in the case supposed; 3.05 per cent. of tar, equal to 3,050 tons on 100,000 tons charged; .48 per cent. of pitch, equal to 480 tons; gas equivalent to 12 per cent. of the coal, equal to 12,000 tons. The cost in Germany, of such a plant as the Cambria Iron Co. is to erect has been

750,000 marks, or $178,600. The cost in the United States might come to $250,000.

The German corporation from which the rights for North America have been purchased bears the title Dr. C. Otto & Co. Headquarters for the new American company are established in Pittsburg and Cleveland. Licenses are to be sold in the United States after the manner in which the Bessemer process was introduced at the first. The cost of these licenses is not to be made burdensome. All essentials of the deal were completed by Wm. G. Mather, of Cleveland; Cyrus Elder, of Johnstown, Pa.; John F. Wilcox, of Pittsburg and Dr. Schniewind, of Cleveland, on a trip from which the first three returned last week. Dr. Schniewind remains in Germany to attend to matters of detail. The expectation is that other plants in addition to that at Johnstown will soon be erected, but the plans are not in shape for mention now.

Dr. C. Otto & Co. rely to a very small extent upon their patents for protection. Their methods, particularly those relating to the recovery of by-products, are secret and this fact has effectually guarded the proprietors. Only a few patents have been taken out in the United States.

That three of the chief producers of steel in the United States should have been engaged in a similar investigation simultaneously with the gentlemen composing the new Otto Coke & Chemical Co. is significant of the important part fuel economies are to play in the blast furnace practice of the immediate future. The movement means, of course, increased independence of the Connellsville region and hence, to a large extent, the elimination of the advantage enjoyed by steel makers nearest that source of supply. If the coals of Indiana and Illinois, for example, can be successfully coked at the works of the Illinois Steel Co., the advantage Chicago now has over Pittsburg in cost of ore will no longer be offset by the handicap of a long coke haul.

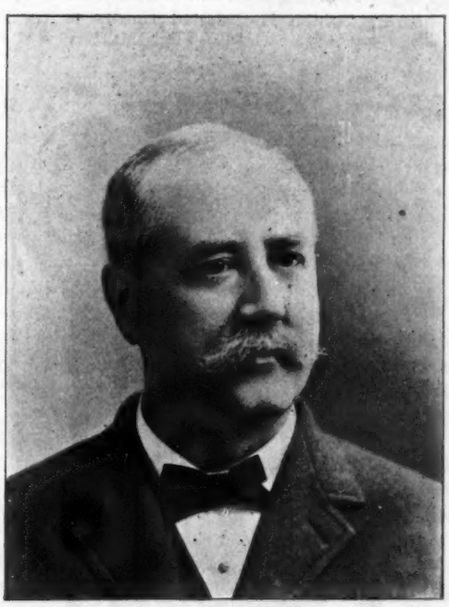
CAR-WHEEL FOUNDRY PRACTICE.

With a 600-pound car wheel selling at $4.50, it does not need to be said that the day of 40 per cent. Lake Superior charcoal, 40 per cent. Salisbury and 20 per cent. old wheels, in a car-wheel mixture, has quite passed away. There are makers of wheels who are adhering to old-time practice to the extent of using a goodly proportion of new iron in their mixture. To such the ¾ cent-a-pound wheel is a mystery. Some of them have not stopped with marveling at it, but have served notice upon their railroad customers that hereafter they will refuse to receive in trade old wheels of certain makes. The "chemically-physicked" wheel has come to be the trade parlance among such wheel founders for the joint product of the chemist and the old wheel pile. That wheels thus made have stood the requirements of some railroads appears to be admitted, but as to their desirability as a component in a car-wheel mixture after they have served their time on the rail, there seems to be some question.

On the other hand, wheel makers who have learned the use of the laboratory contend that the proof of the quality of a product is in its acceptance in numbers sufficient to call for a steady output in the midst of depression. The railroads, meantime, are finding it to their interest to look carefully into the drift of the car wheel trade, and the attitude of foundrymen of the old school as to exchanges presents a problem in the solution of which they must take a hand. The fact that a gross ton of old wheels that one day brought within a dollar of the price of charcoal iron can now be bought at from $4 to $5 less than the iron, indicates that the accumulation of old wheels is greater than it once was.

To know whether the modern method of getting a cheap wheel ensures one as reliable as the higher priced product of the old days is of utmost interest and importance to the railroads. No less important is the determination of this question to the wheel maker, not to mention the charcoal furnaceman, who between the coke furnaceman, who is getting his iron into car wheel mixtures, and the foundryman employing old wheels exclusively, is finding his market more and more circumscribed.

THE LATE JAMES H. LINDSAY.



Mention was made last week of the death at his home in Allegheny, Pa., Sept. 24, of James H. Lindsay, for many years one of the most prominent iron manufacturers in the Pittsburg district. Mr. Lindsay's connection with municipal affairs in Allegheny, the city of his birth, and his public spirit and works of charity made him one of the best known of Allegheny's citizens. For twelve years he had been president of the select council of the city, and had been in common or select council for 25 years. In 1880 he was a delegate to the Republican National Convention at Chicago and was one of the "306" who voted for General Grant to the end. Mr. Lindsay was born Jan. 8, 1841. His father was an iron manufacturer and at 24 the son became a member of the iron firm of Lindsay & Whipple. A few years later James McCutcheon, a relative, bought out Mr. Whipple and the firm was known as Lindsay & McCutcheon. They operated the Star Iron & Steel Works in Allegheny, which were built in 1862. Mr. Lindsay was a director also of the First National Bank, vice chairman of the Keystone Rolling Mill Co., and an official of the Pittsburg Tube Co. Last Spring he was taken ill and later went to the seashore, returning home in a few months somewhat improved. Then came a relapse and complications that were beyond help. His wife and five children survive him.

THE special claim made for the molding machine of the Tabor Mfg. Co., of which a cut and announcement appear on another page, is that it is the only power molding machine adapted to different sizes and shapes of flasks. This permits of a range of work by one machine that ordinarily would require several machines. These machines can be seen at the Elizabeth, N. J., plant of the company. Inquiries concerning them should be addressed to the New York office.

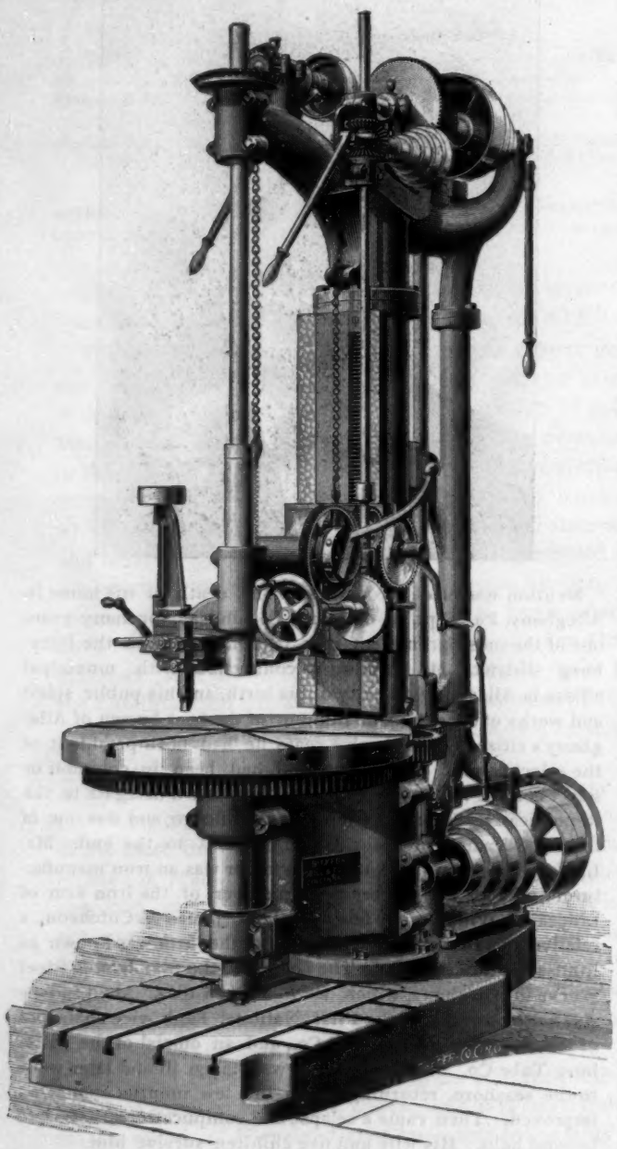
THE Carnegie Steel Co. has posted a notice at its Edgar Thompson Steel Works and at the Homestead Works, that a readjustment of the present scale of wages would be made Jan. 1. The change will chiefly affect tonnage men.

MACHINE SHOP AND FOUNDRY.

DRILLING, BORING AND TURNING MACHINE.

The illustration given in this connection is of a 40-inch boring and turning mill, in combination with a 40-inch upright drill of the latest design of the Bickford Drill & Tool Co. The machine in all its parts is constructed for durability and convenience of handling, and many new and improved features which are due to a long experience of the designers in modern machine manufacturing can be found directly by a glance at the illustration.

The table, or rather its strong spindle, revolves in two long bearings of the swinging arm, and in addition is supported by a foot bearing, which is fastened rigidly to the base. A



hardened steel toe is inserted in the end of the spindle, the toe finding its support on a hardened steel plate, which is always submerged in oil. This plate can be raised or lowered by means of a screw according to the desired speed of the revolving table.

The table with its supporting arm can easily be swung around the column on anti-friction rollers, which are in an annular groove at the bottom of the arm, and by fastening the foot bearing to the base plate, it brings the center line of the table spindle exactly central with the drill spindle, and no setting or adjusting is required. The table is indirectly driven from the top shaft of the machine by means of a steel miter wheel which matches into a miter wheel on the vertical shaft between column and back brace. On the end of this shaft, which can be raised or lowered to bring the miters out or into match, is a spur pinion, which drives by means of the column surrounding the intermediate wheel, the spur ring of the table. By the peculiar appliance and combination of the gearing on the top shaft, the spindle and table can revolve together, thus giving the machine the qualification of a double-head boring and turning mill.

The strong and heavy front arm slides on the V-shaped face of the column very easily. It has long gibbed bearings and can be raised or lowered either direct by crank handle, or by worm and worm wheel, and the same hand wheel, which serves for feeding the drill spindle by hand. It can also be fed up or down by power, same as the spindle without much change in the feed mechanism, by throwing in an intermediate gear on an oscillating lever. The front arm has on the left side a strongly braced extension, which carries the carriage and tool holder. The carriage can be fed either automatically or by hand from the right to the left or vice versa, as on any ordinary turning mill.

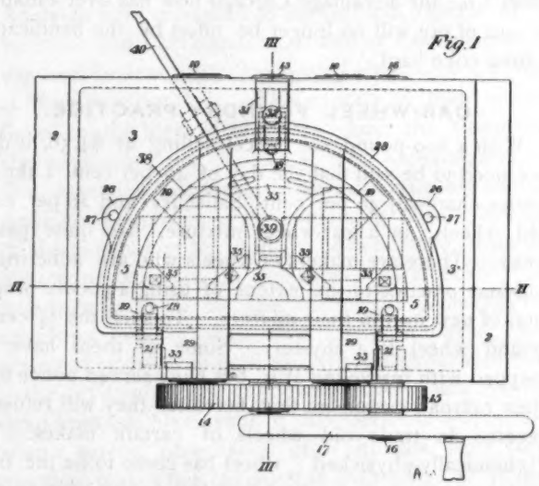
There are four different speeds for turning, as well as for drilling or boring, and eight different speeds for the rotation of table and spindle. The front arm or head and spindle are counterbalanced by chain and weight. All handles for changing feeds or speeds of the machine are in a convenient reach. The spindle shafts and studs, likewise the main gearing, are made of steel.

In all small details the machine is correct and to the highest point of machine tool building, consequently the manufacturers give the strongest guarantee for the efficiency of the tool. Any other information, together with prices, can be had by addressing the manufacturers, Bickford Drill & Tool Co., Cincinnati, O.

STERRIT MOLDING MACHINE.

A machine for making wheel molds invented by Wm. B. Sterrit, of Pittsburg, is shown, in its essential features in the three illustrations presented on this page. Fig. 1 gives a top plan view of the machine. Fig. 2 is a vertical longitudinal section on the line II-II of Fig. 1, and Fig. 3 is a vertical cross section on the line III-III of Fig. 1. Similar numerals indi-

Fig. 1



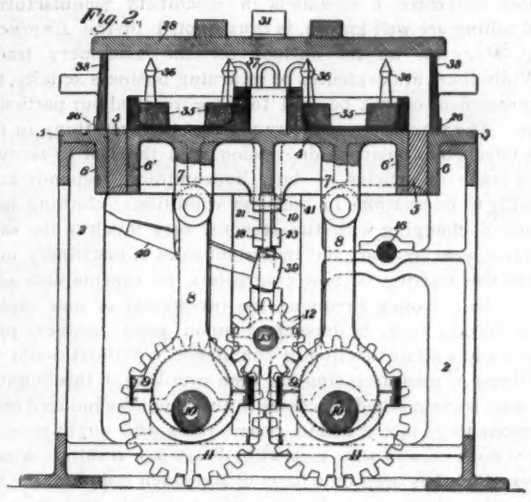
cate corresponding parts, 2 representing the frame of the machine and 3 the molding table. This table is provided with an opening of the same contour as the pattern but of larger perimeter. In this opening are the movable pattern board 4 and the ring 5, the ring being guided in its vertical reciprocation by the depending flange 6 surrounding it. Grooving this flange 6 reduces the friction and the power necessary to raise and lower the pattern and the ring, the depending flange 6^1 of the pattern-plate being similarly recessed.

The arms 8 are pivoted to the downwardly projecting lugs 7 of the pattern-plate. These arms project from eccentric straps 9 surrounding eccentrics upon shafts 10. These shafts are provided with gear wheels 11, intermeshing with a pinion 12 upon a shaft 13 carrying a gear wheel 14 (Figs. 1 and 3) intermeshing with a pinion 15 upon a shaft 16 carrying the hand-wheel 17. This system of gears greatly increases the power.

The ring 5 is provided with depending headed bolts or pins 18, about which are the forked lugs 19, projecting outwardly

from the pattern-plate and having inwardly beveled outer faces 20. There are five of these forked lugs and three of the headed bolts are provided, disposed at about equal distances apart. To support the ring in its elevated position, are the swinging latches 21, pivoted to the frame at their lower ends and each provided with an inwardly projecting lng 22, which lies between the forks of the lugs 19, and below this lug with inclined faces 23 adapted to contact with the inclined faces 20 of lugs 19 when the pattern-plate is lowered. These latches are normally held in inward position by springs 24

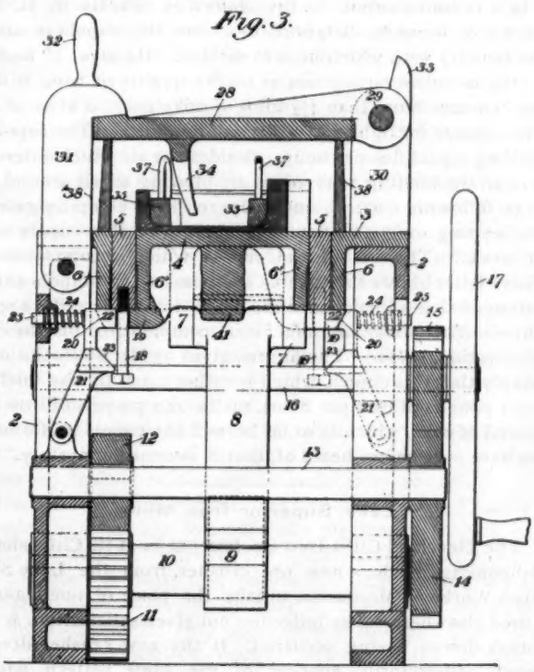
Fig. 2.



surrounding pins 25 projecting therefrom and pressing upon their upper ends, the lugs 19 forcing the latches back out of engagement with the ring when the pattern-plate descends, and then drawing down the ring by engagement of the forked lugs with the heads or bolts 18.

The flask 38 is guided into proper position by lugs 26, through holes in which pass pins 27 projecting from the table, and is securely held down by the cover 28, which is hinged at 29 to suitable posts, and when swung down upon the flask is

Fig. 3.



secured by the swinging latch 31 pivoted below the table and having the operating handle 32.

The posts 30 are provided with lugs 33, which engage the cover-plate as soon as it is moved backward slightly beyond the vertical and prevent further backward movement. The under side of the cover-plate is provided with a series of venting pins 34, which have downwardly curved and tapered sides so as to move out of the sand without sidewise movement when the cover-plate is lifted.

To rap the mold and loosen the pattern from the sand, a hammer 39 is provided whose handle 40 is suitably pivoted in the frame, and which is arranged to strike against a lug 41 projecting from the bottom face of the pattern-plate.

To prevent the breaking and crumbling away of the corners and sharp edges of the mold when the pattern is withdrawn, metal plates 35 or blocks are provided which rest upon the pattern-plate and are forced up into the sand forming the corners of the finished mold. These blocks are provided with suitable upwardly projecting holders, which are either in the form of sharpened pins as 36, or loops as 37, the sand being forced inwardly below the enlarged and sharpened heads of the pins, and through the loops, thus securing the blocks in place.

The machine is simple and easily operated and in dispensing with hand manipulation works economies which are readily apparent.

MACHINE SHOP PRACTICE OF THE FUTURE.

In an article on "Modern Machine Tools" in the October issue of the *Engineering Magazine*, Mr. Oberlin Smith traces the various important developments in the manufacture and use of machine tools in the United States. "In general," he says, "the improvements which have enabled so much more and better work to be done in our machine shops than was done a quarter of a century ago, have consisted, to a great extent in making the machines heavier and stronger and also much more convenient to manipulate. A greater gain, however, has been made by the use of special machines for special operations, as for instance axle-lathes, pulley-lathes, car-wheel-borers, etc." From the portion of the article referring to the changes that are ahead in machine shop practice and the new adaptations of tools that are to come, we take the following:

The future development of our machine shops is difficult to foresee, but will, I think, be somewhat as follows: Our lathes will have very much larger spindles, both live and dead, the former, especially, being increased in diameter perhaps even three or four-fold, where used for chuck work, as we cannot afford much longer to go on practicing an outrageous sacrifice of time, of machine and operator for the sake of saving a little journal friction. These lathes will have more convenient devices for reversing and changing feeds and will, like our most modern planers, be easily set to take a feed from ½″ to 1″ wide for certain finishing operations, etc. They will, too, be more specialized into chucking, center turning, screw-cutting, and polishing lathes, and will not attempt to perform any of these functions at will as much as is now the case, thereby nearly spoiling the machine for all of them. A chucking lathe with the spindle as large in diameter as is its average work is no worse in respect to friction than is a planer with its table friction moving at the same speed as the cutting. We shall therefore have 20″ swing lathes with the large spindle-bearing 10″ or 12″ in diameter, instead of the pipe-stem affairs now in vogue. The frame work of these lathes will of course be greatly increased in weight and stiffness—as will also the driving gear.

Our drill presses will follow pretty much the same lines and will be arranged with a reversing gear to facilitate tapping, left-handed facing, etc. They will be supplied with portable turret-tools, so that several sub-operations can follow each other without resetting the work.

Our milling machines, too, will follow suit, having more convenient changes of feed, vastly stronger spindles, driving gear, etc. In all of these tools there will be a tendency to drive by worm rather than spur gearing, thereby easily applying greater power, avoiding undue vibration, and getting the smoothness of motion attained in the planing machines before referred to.

Our planers, shapers, slotters, etc., will be improved chiefly in the line of vastly greater stiffness. Especially will this be the case in the main side posts of the ordinary type of planer, which always have been, and still are ridiculously weak in a lateral direction, making it (as is well known to every machinist) almost impossible to produce a vertical planed surface with anything like the degree of flatness that is attained in horizontal work laid directly upon the table. Why these posts should always have been made so strong fore and aft to take the direct stress of the tool, and have been made so

extremely "floppy" in the other direction, has entirely passed my comprehension.

Our gear-cutters will, it is to be hoped, be vastly improved by making the indexing spindle four or five times as large in diameter as at present, with proper arrangements for driving the gear-blank to be cut with some clamping or chucking device so that it cannot slip around upon its arbor, as is now often the case, especially if the cutter is sharper upon one side than the other. That the spindle itself shall not yield torsionally between the working end and the index wheel is of course sufficient reason for greatly enlarging it—and there is no possible objection. These spindles should also be hollow, with a large opening that pinions may be cut when made in one piece with their shafts.

The above are but a few instances of the radical improvements wanted. In general, it may be said that the most important change required is an average doubling or trebling of the weight, for a given capacity, of all sorts and conditions of machine tools. This use of what the writer has for some years past, in various publications, termed the "anvil principle," in contradistinction to the "fiddle principle" now embodied in so many of our machines, and particularly in those familiarly known as "Yankee tools," will undoubtedly do more to increase the production, as well as the accuracy of our machine shops than any other one thing. This increase can be very cheaply purchased with cast iron at its present, and probably future price, and with it will be purchased a freedom from vibration and a capacity for *heavy cuts* not now, I think, realized by most shop-owners. In regard to materials for machine tools the old stand-by, cast iron, seems good enough for most purposes and very difficult to improve upon. Yes, even for lathe-spindles, although possibly it may not yet be quite orthodox to say so, there is probably nothing better than this metal, running in boxes of the same—*provided* the diameter is large enough.

Another radical change which the near future will probably see in our machine shops, will be the abolition of shafting and belting, and the direct driving of each machine with its own electric motor, simple pieces of conducting wire coming up through the floor, being substitutes for the tangled mass of timbers, hangers, shafting, pulleys, clutches, counter-shafts, shipper-rods and handles, ropes, belts and weeping oil-cups which are now the source of so much noise, inconvenience, danger and waste of power. Each machine handling heavy work will probably be provided also with its little electric hoist acting as an auxiliary to the electric traveling cranes which can then traverse umimpeded the whole field of every ceiling.

Besides the improvements in *materiel* which we have prefigured, the *personnel* of our machine-shops will undoubtedly be greatly improved, not only by an influx of many more workmen from our technical and trade schools than we have hitherto enjoyed, but by the moral and mental influence upon all the men of the cleaner and lighter electrically driven, lighted and heated shops, which the future will bring us. These men will, by their more scientific methods, and by a more rigid system of shop government, learn to waste less time than now in laying out and in setting their work, and will cause their machines to waste less time by the ridiculously light cuts and narrow feeds which are yet so prevalent, even in some of the best shops.

What the future may do in superseding entirely some of our present crude processes by some system of separating metals in proper lines of cleavage, instead of forging and casting the wrong size and shape for the sake of paring and scraping a good deal of it away in chips, it would be only chimerical to prophesy. It seems very certain that in this generation we must go on plowing and digging down to the finished surface of our work, as in the past; but potent factors which will enable this to be done more sensibly and at a considerably higher speed than we are accustomed to, will be by more mental plus stored-up brains in machines, and by more brains plus training in men who operate them.

SHOP AND FOUNDRY NOTES.

Fred H. Colvin gives some wholesome counsel on shop management in the *American Machinist*. He finds it difficult to establish rules that will fit all cases. The question of the proper relation between superintendents and workmen is considered, and the writer takes the ground that lack of harmony between them is positively costly to proprietors, as well as disagreeable all around. He believes that, "in the great majority of cases there is no excuse for the superintendent dealing with any one but his foreman, and when this is done the efficiency of the shop will be at its best if general plans are laid right."

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C. A. Moore, of Manning, Maxwell & Moore, New York, whose extensive connections in machinery manufacturing and selling are well known, is thus quoted by the *Engineering Magazine* on the outlook for the machinery trade: "While there are evidences of returning business activity, the improvement cannot be said to have reached our particular line. The machinery industry is about the first thing to feel the effects of a business depression, and the last to recover. The trade in articles of daily consumption responds most readily to fluctuations in business conditions; clothing is in demand, changing with the seasons, very much in the same volume, year by year; but important sales of machinery must await the starting of new enterprises, or considerable additions to old ones, involving the investment of new capital, and that, in turn, is dependent upon good business prospects and a settled feeling of confidence. Without doubt the business of manufacturing has been overdone in this country; at least some marked successes in this business induced many persons to go into it within recent years who ought never to have done so, and who met with disastrous results. Almost everything has been on a basis of too much inflation. * * * For more than a year the eyes of our people have been too much upon Washington, where both the Sherman-law repeal and the revision of the tariff occupied more time than was anticipated, during which period the people had their minds distracted from business, and industries came to a standstill. The end has been reached in this respect, however, and meanwhile a course of general liquidation has been in progress, and a gradual but slow revival of business may be expected as confidence is re-established."

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In a communication to the *American Machinist*, H. Bollinckx, of Brussels, Belgium, describes the cupola in use in the foundry with which he is connected. He says: "Besides giving us entire satisfaction as to the quality of iron, it does not consume more than 4½ kilos of coke per 100 kilos of pig iron (charge for lighting the fire not included.) The cupola is melting 2,500 kilos per hour. Besides the air which enters all around the melting zone, pipes are blowing air all around and over, following a spiral, and help to burn escaping gases of the melting zone. No flames escape out of this cupola when at work." The cut of the cupola which accompanies the above letter shows the tuyeres surrounding the cupola and so arranged that a line connecting them would describe a spiral curve. The *American Machinist* commenting on the communication, says: "The figures given by Mr. Bollinckx mean simply that this cupola, which is rather small in size (melting 5,511 pounds of iron per hour), melts 22.2 pounds of iron to 1 pound of coke, which is so far beyond any cupola performance we have ever before heard of, that it becomes a mystery."

Lake Superior Iron Mines.

The Cleveland-Cliffs Iron Co. has put in at its Cliffs shaft at Ishpeming, Mich., a new ore crusher, from the Lake Shore Iron Works of Marquette, to take the place of one manufactured elsewhere. The latter has not given satisfaction, several break-downs having occurred. If the new crusher does its work satisfactorily another of the same pattern will be put in.

President Hill announces that the Great Northern Co. has no intention of extending the Fosston branch across the Mesabi range to Duluth as has been stated in the daily papers. He says this line will not be extended for the present, and no work on it is likely to be done next year.

The Chapin mine is now working 615 men, the daily output running from 1,800 to 1,900 tons.

Arrangements are said to have been made for the resumption of operations at the Crystal Falls mine, through the reduction of the royalty to a very low figure.

THE BLAST FURNACE.*

BY E. C. POTTER.

Raw iron, or "pig iron" as it is commonly called, is produced by deriving from iron ores (oxides of iron) the metallic iron they contain in their composition. Stated briefly this is accomplished by exposing the ores to the chemical action of carbonic oxide, formed by the combustion of coal or coke, which, by taking up the oxygen of the oxides of iron leaves the metallic iron free. In addition to this the earthy impurities of the ores have to be dealt with in a manner to be explained later.

The apparatus in which this process is carried on is known as a blast furnace, so called because the ordinary combustion of the fuel is augmented and accelerated by forcing into the furnace by mechanical means large volumes of air. This air, delivered into the furnace under high pressure, is known as "the blast." As indicated above, the materials to be dealt with in the operation, are, first, the ore; second, the fuel by whose combustion we obtain the active element in the reduction of the ore, carbonic oxide; (this fuel is a more or less pure carbon in the shape of charcoal, coke or anthracite coal); third, a material technically called a "flux" is required whose office is to remove the earthy impurities of the ores. For this purpose limestone is usually employed. The way in which this is accomplished is rather an intricate chemical reaction, but stated as simply as possible the reaction is as follows: The principal earth associated with the ore is common clay, or silicate of aluminum, as it is chemically called. This material, as every one knows, is quite infusible and hence impossible to remove by the mere application of heat. It is a chemical fact, however, that by the addition of lime to the silicate of aluminum, forming the double silicate of lime and aluminum, this double silicate being quite fusible and being lighter than the metallic iron floats upon its surface, and is thence drawn off in a manner to be indicated later.

This is, briefly, the office of the flux. These three materials together with the air blown into the furnace are all that are required to carry on the operation of smelting pig iron. I mention the air, as that is not by any means as insignificant a feature as would be at first imagined; for the actual *weight* of air blown per ton of iron produced is six or seven times the weight of the solid materials charged.

The blast furnace itself is a very large structure, circular in section, of a height varying from 60 to 90 feet and a largest diameter of about one-fourth the height. The contour of the interior is not that of a perfect cylinder, but from the point of largest diameter (technically called the "bosh" diameter) the walls are drawn in both upward and downward so that at the bottom of the furnace the diameter is only about one-half the bosh diameter and at the top about 30 per cent. smaller than the bosh. The lowest part of the furnace is called the "hearth" or "crucible," for it is here that the molten iron collects before being drawn off. The walls of the crucible are from five to six feet in height and usually perpendicular. From the top of the crucible walls the furnace slopes outward and upward till the bosh is reached This whole section of the furnace is also known as the "boshes," and it is here that the actual fusion of the materials takes place. From the bosh up to the top the walls slope in again.

The materials, viz. ore, fuel and flux—are charged into the furnace from the top by means of a mechanism known as a "bell and hopper," which at the same time closes the top of the furnace. A heavy cast iron hopper is fitted over the top of the furnace, leaving an opening in its center of about half the bosh diameter. This opening is closed by a heavy iron bell, lifted into position from the interior of the furnace so that the lower edge of the bell laps over the lower edge of the hopper on its under side for three or four inches. Thus when the bell is drawn up tightly against the hopper the furnace is tightly closed even to the escape of gas. The materials are then dumped into the hopper until it is full, when the bell is then lowered by means of a mechanically actuated and balanced lever arm so that a space of 15 to 20 inches is opened between the contact edge of the bell and hopper, and through this space the materials slide over the sloping sides of the bell into the interior of the furnace. This bell shape is used for the purpose of obtaining an equal and uniform distribution of the materials over the area of the furnace, which would not be possible were the materials dumped into an ordinary opening. This uniform distribution in charging is very important to the uniform working of the furnace; for if the materials were all dumped into the center or to one side the ascending carbonic oxide gas, seeking the easiest way out, would but imperfectly act upon the great mass accumulated in one locality and the furnace would work one-sided. The great height of the furnace is required in order to expose the ore for a sufficiently long time to the action of the carbonic oxide. The descent of the ore from the top to the bottom of the furnace occupies from 18 to 24 hours. On a level with the floor of the crucible, on the front side of the furnace, is situated the "tapping hole." This hole pierces the wall of the furnace to its interior and through it the molten iron is drawn out. The tapping hole leads directly into a trough which communicates with the casting beds. This hole is stopped up with clay during the time the iron is collecting in the crucible. Tapping takes place usually every six hours. About three feet above the tapping hole and sometimes directly over it, sometimes to one side, is the slag tap or "cinder notch" as it is technically called. The slag formed by the flux, floating upon the surface of the iron is is here drawn off from time to time as it rises to this height. It is usually run directly into buggies or cars constructed for the purpose and hauled off to the cinder dump.

The blast is introduced into the furnace at the top of the crucible, about five or six feet above the floor. At six or eight equidistant points in the circumference of the furnace wall openings are made into the interior of the furnace. Into these openings water-cooled "holders" of bronze or iron are fitted. Into these holders are accurately fitted the blast nozzles or "tuyeres," also water-cooled. The water-cooling is accomplished by casting a coil of pipe in the iron holder or tuyere through which water is continually forced, or in the case of the bronze tuyere and holder the walls are made double with a space between in which water is kept circulating. At a sufficient height above the tuyeres a main blast pipe encircles the furnace from which branches are led down to each tuyere. The tuyere nozzles are inserted from six to ten inches beyond the inner wall into the furnace. The water-cooling of the tuyeres and holders, while designed primarily for their maintenance, aid much in preserving the brick work adjacent to them. Following up this hint, the bosh walls of the furnace are now greatly prolonged in life by inserting rows of water-cooled plates completely encircling the furnace at distances of about 30 inches between the rows. These are built in the brick work and are invisible except the outside edge of the plate and the water connections. These plates are removable in case of leak, which is rare.

The accessories to the blast furnace proper are the boilers, blowing engines, hot-blast stoves, hoists and water supply. The boilers and stoves are heated by waste gases from the furnace, so that the furnace is practically self-supporting in the matter of power, the only fuel necessary being that put into the furnace for the purpose of smelting. The furnace gases rise to the top of the furnace and are thence conducted away by a large pipe called "the down-take," which carries the gases down to the main flue which lies underground. This flue conducts the gases to the boilers and stoves. The lower end of the down-take is enlarged just before it enters the flue into a chamber of considerable size known as the "dust-catcher," which name sufficiently describes its function. The gases carry with them considerable quantities of dust which accumulate in the flues, stoves and boilers, seriously impairing their efficiency by choking them. This the dust-catcher is designed to obviate. The boilers and blowing engines need little description, as they speak for themselves. The use and operation of the hot-blast stove is a subject of much interest, and to the furnaceman it is a very considerable factor in the furnace economy.

It is apparent that if air at the temperature of the surrounding atmosphere be blown into the furnace it will require a certain amount of fuel to bring it up to the temperature of the fusing mass. If this air could be heated, and that, too, without further expenditure of fuel, before it is delivered into the furnace it is evident a considerable economy of smelting fuel

*Read at the meeting and dinner of the Western Foundrymen's Association at Chicago, Wednesday evening, Sept. 26, 1894.

must result. This is what is accomplished by the hot-blast stove. The waste gases of the furnace, which formerly were permitted to escape into the air, are by this apparatus utilized for the heating of the blast. Stoves as constructed now-a-days consist of a large shell of tank plate enclosing a mass of firebrick so disposed as to form a large number of small flues or checkerwork. Each stove measures from 15 to 20 feet in diameter and 60 to 70 feet in height, being nearly as large as the blast furnace itself. A total cross-section area of, say, 300 square feet is subdivided by the brickwork into a large number of small flues of, say, 40 square inches, thus multiplying the heating surface enormously. These flues are constructed perpendicularly. The gas is admitted at the bottom of one side into a chamber where it is mixed with the proper proportion of air to produce combustion; thus ignited it rises to the top of the stove where it is deflected down again through a series of small flues. On reaching the bottom it is deflected up again and then down, having traversed the height of the stove four times before it passes off by the chimney. The gas having been passed through the stove a sufficiently long time to bring the whole mass of brickwork to a bright red heat, it is then shut off and the blast from the blowing engines is then admitted on the *opposite* side of the stove from the gas, and is made to travel over the same path through the stove in the *reverse* direction. During its passage it absorbs the heat from the brickwork, raising its own temperature to from 1,200–1,500 deg. F. From the stove the air is then carried by the blast main directly to the tuyeres. There are usually three and sometimes four stoves attached to each furnace. Each stove is kept on gas for two hours and on air for one hour; three stoves therefore permit of two stoves peing kept continually on gas and one on air, a stove being changed every hour. Of course before the blast is shut off of one stove it is admitted through a fresh one, as the blast must be kept continuously on the furnace.

Another valuable feature of the hot blast stove is the fact that it places within the control of the furnace manager an amount of caloric or heat energy entirely subject to his manipulation; thus, if the furnace is disposed to work cold an increase of temperature of the blast will usually act as a corrective, and vice versa. In the uniform production of a desired grade of iron this is of the highest value. In this connection a very brief consideration of the chemistry of pig iron may not be out of place.

In recovering from the ore the iron it contains we do not obtain that iron chemically pure, nor is it desirable that we should do so. We have seen how the earthy impurities were to a considerable extent removed, viz.: the silicates of alumina, lime and whatever of magnesia there may be in the ore. But certain other elements, notably phosphorus and manganese, are not thus removed; nor are they ever completely removed, the second only partially, the first not at all. In addition to the impurities of the ores we are adding with the fuel, especially where coke is used, another lot of impurities, notably silica and sulphur. Silica, or silicic acid, as it is chemically called, being a compound of silicon and oxygen is not capable of being decomposed into its constituent elements, silicon and oxygen, except at the very highest heat. Therefore, out of the very large amount of silica in the form of silicates that is charged into the furnace, we find only a comparatively small proportion appearing in the pig iron as silicon, which has doubtless been decomposed in some areas of very high temperatures before the tuyeres. A portion of the sulphur is carried off in the slag, but enough remains to make a deal of trouble to the pig iron consumer. In the resulting iron, then, we find in addition to the metallic iron such impurities as silicon, sulphur, phosphorus, manganese and carbon. The carbon in pig iron exists in two states, free carbon in the form of crystals or flakes and combined or dissolved carbon which has been taken up by the iron before the tuyeres. The proportions in which these two conditions of carbon exist in the pig iron depend upon the temperature of the furnace; if the furnace is hot, the carbon exists in very large percentage as free carbon or graphite; if the furnace is working cold, the carbon in the iron will be found largely as combined carbon with little graphite. So, too, as might be inferred from what was said before, a cold iron will contain little silicon, as the temperature before the tuyeres has not been sufficient to decompose the silicic acid. The temperature also has a marked influence on the behavior of the sulphur. With the furnace working hot, it is nearly all carried off in the slag, but at lower temperatures its greater affinity for the iron asserts itself and a cold iron is found to contain an objectionable amount of sulphur. Cold iron, therefore, will be low in silicon, low in graphitic carbon and high in sulphur; for most purposes an undesirable combination. The value of the hot-blast stoves in enabling the furnace manager to correct the temperatures of his furnace is thus made plain.

The operations of the blast furnace are continuous until the fire-brick lining wears out. This occurs in from two to three years under ordinary circumstances; or, a better way of stating the life of the lining is that it will generally yield 125,000 to 150,000 tons of iron, though one or two of America's famous furnaces have turned out 300,000 and even 400,000 tons on a single lining. The management of a blast furnace, the proper mixing of the materials, the regulation of the working of the furnace itself for the production of a large, uniform and economical output calls for the highest skill, watchfulness, patience and often courage. An accident to the furnace is almost always expensive and often dangerous; the apparatus is always operated under high pressure and the highest heats known to science. Altogether the management of a blast furnace presents a most intricate problem in economical metallurgy.

Bethlehem Shafting in the Western Field.

The Bethlehem Iron Co., of Bethlehem, Pa., has recently made arrangements with Messrs. Fisher & Porter, 1025 Monadnock Block, Chicago, for representation in the territory surrounding the Great Lakes and west of Pennsylvania. The Bethlehem Iron Co. has recently furnished shafting to Wm. Cramp & Sons, for vessels for the U. S. Government and for the American line steamers City of Paris and City of New York. Messrs. Fisher & Porter are prepared to push this branch of the Bethlehem Co.'s business in this territory, and will furnish shafts for lake vessels, and for engines, pumps, air compressors and mining machinery of all kinds. They will also sell connecting rods, cranks, cross heads and other forgings for engines and general machinery. Shafting will be supplied either solid or hollow forged, as desired, and finished or rough turned. The quality of the forgings of the Bethlehem Iron Co. is shown by the fact that when the City of Paris and City of New York were turned over to the American Line, the English shafting in them, which was found to be imperfect, was replaced by shafting made by the Bethlehem Iron Co. The new shafting was absolutely true in every particular, and the next trips taken by these steamers were made in record-beating time.

The shafting made by the Bethlehem Iron Co. is from an open hearth steel ingot, which is subjected to 7,000 tons hydraulic pressure, making an absolutely homogeneous metal. After the ingot cools the center is bored out and an incandescent electric lamp is then passed through to discover any possible imperfections, that they may be correeted. The ingot is then reheated, and a mandrel put through the hole, after which the shaft is forged out to the proper length and diameter by a hydraulic press capable of exerting a pressure of 14,000 tons if necessary. The shafting is then turned and finished, and is ready for shipment.

In the Connellsville Region.

The number of coke ovens active in the Connellsville region went 454 beyond the 15,000 mark in the week ending Sept. 22, and further increase is expected, the *Courier* intimating that the 16,000 figure is likely to be reached by Oct. 15. The production was estimated by the last report at 149,775 tons a week. The number of idle ovens was 2,060. While orders are of good volume, operators do not seem able to establish a higher basis of values. The shipments of the week were 7,432 cars, of which 1,995 went to Pittsburg and river tipples, 3,992 cars to points west of Pittsburg and 1,445 cars to points east of Connellsville—a net increase of 231 cars. Several hundred negroes were induced to quit work at the mines and ovens last week by men who pretended to be employment agents for government work. Strikers out of work are now said by the negroes to have taken this method of getting their jobs.

WESTERN FOUNDRYMEN'S ASSOCIATION.

The September meeting of the Western Foundrymen's Association took place on the afternoon and evening of Wednesday, Sept. 26. At the invitation of Pickands, Brown & Co., sales agents for the pig iron manufactured by the Illinois Steel Co., the Association visited the works of that company at South Chicago, in the afternoon, leaving Chicago on the 2 p. m. train on the Illinois Central. The Association and its guests were taken, by special arrangements, into the Illinois Steel Co.'s yards at South Chicago, near the blast furnaces and steel works.

Those present on this occasion were the following: John M. Sweeney; Geo. M. Sargent, W. D. Sargent, G. H. Sargent, the Sargent Co.; E. G. Elcock, Peter Maischall, Hansell, Elcock & Co.; S. T. Johnston, Whiting Foundry Equipment Co.; Maj. Malcolm McDowell, McDowell Steel Co.; C. S. Reed, Chicago Retort & Fire Brick Co.; W. M. Wilson, S. Obermayer Co.; R. W. Hunt, R. W. Hunt & Co.; F. B. Whitcomb; S. Dauchy, Dauchy Iron Wks; E. C. Potter; E. J. Welch, Robert Craig, Weir & Craig Mfg. Co.; John H. Blood; W. W. Backman; Wm. Francis, King & Andrews Co.; H. S. Vrooman, N. C. Fisher, Garden City Sand Co.; Jas. Frake; H. A. Keith, East Chicago Foundry Co.; W. C. Waterbury, H. L. Waterbury, C. E. Lewis, Forster, Hawes & Co.; John J. Meehan, J. Henry Debus, Lake Shore Foundry Co.; C. H. Vannier, G. W. Henderson, Griffin Wheel Co.; C. I. Bewley, McCormick Harvesting Machine Co.; L. Wolff, Jr., C. J. Wolff, L. Wolff Mfg. Co.; M. D. Bastues, Reedy Elevator Co.; D. L. Cobb, Sloss Iron & Steel Co.; G. D. Turner, Turner, Dickinson & Co.; H. S. Pickands, Pickands, Brown & Co.; W. Nygren, King & Andrews Co.; W. E. Wakefield, John Featherstone's Sons; A. Sorge, Jr., Fraser & Chalmers; W. S. Cummings, Board & Cummings; F. H. Taylor, Union Foundry & Pullman Car Wheel Works; S. C. Hibben; C. H. Besley, C. H. Besley & Co.; T. A. Hagerty; E. C. Greenlee, Greenlee Bros. & Co.; J. F. Laubender; A. M. Thompson, Link-Belt Machinery Co.; E. W. Yeomans, E. W. Yeomans & Co.; J. R. Graves, Chicago Stove Works; A. C. Ely, James Fyfe, C. P. Wheeler, Pickands, Brown & Co.; Geo. W. Cope, J. K. Hanes, *Iron Age;* J. B. Mansfield, *Industrial World;* F. H. Clarke, *Railroad Gazette;* B. M. Gardner, *Iron Trade Review*, Chicago; A. W. McArthur, Rockford Foundry Co., Rockford, Ill.; C. A. Sercomb, Schwab & Sercomb, Milwaukee, Wis.; C. C. Heald, Union Malleable Iron Co., Moline, Ill.; W. D. Turner, H. N. Wade, United States Wind Engine & Pump Co., Batavia, Ill.; Thos. Snow, Challenge Wind Mill & Feed Mill Co., Batavia, Ill.; C. H. Woodruff, J. C. Daniels, C. H. Woodruff Co., Elgin, Ill.; E. A. Wheeler, Wheeler Furnace Co., Sharon, Pa.; Alfred D. Edwards, Illinois Iron & Bolt Co., Carpentersville, Ill.; M. N. McLaren, Edward P. Allis Co., Milwaukee, Wis.; L. A. Baker, L. A. Baker & Co., Elgin, Ill.; Lewis J. Cox, Terre Haute Car & Mfg. Co., Terre Haute, Ind.; H. M. Lane, Lane & Bodley Co., Cincinnati, O.; A. L. Hott, A. L. Hott & Co., Harvey, Ill.; F. B. Bain, Morris Foundry Co., Morris, Ill.; John A. Penton, *Foundry*, Detroit, Mich.; L. E. Ellsworth, Racine Hardware Co., Racine, Wis.; C. F. Austin, F. F. Collins Mfg. Co., San Antonio, Tex.; W. N. Moore, Lewis Moore, Joliet Stove Works, Joliet, Ill.

AT THE ILLINOIS STEEL CO.'S WORKS.

Immediately after arriving in the yards of the steel works, the visitors were taken to the Bessemer converting department, where they witnessed several blows. The three converters were running on rail steel, taking charges of 25,000 pounds of metal, and pouring six ingots to a heat. The charges were of direct metal brought from the blast furnaces in small cars on an elevated railway passing in front of the converters. The gentlemen present were told that while direct metal was usually employed, it was sometimes necessary to run a cupola to melt pig and scrap. Of the two cupolas at the works, but one is in operation at a time. With one cupola as high as 327 tons of metal have been melted in 12 hours at these works, while more than 300 tons are often melted in the same time.

A great deal of interest was shown by the members present in the methods of handling ladles, stripping ingots, and placing and removing ingot molds, which was done easily and with dispatch, by hydraulic cranes.

From the converting plant the visitors were taken to the blooming and rail mills. The foundrymen were astonished to see the enormous quantity of machinery running so easily, with so very few men in attendance, and with no appearance of haste. They were told that 1,200 tons of rails would be made in the 24 hours then passing. From the time that the hot metal leaves the blast furnace until the rails are placed in the cooling sheds complete, no manual labor is used in the entire operation. Automatic machinery plays almost a human part in the various manipulations.

The mill has recently been arranged so as as to roll billets as well as rails. Shears have been put in to cut the billets to the required length, and a conveyor has been built in the wall of the mill to carry the billets automatically into the yard, where they are elevated over docks on which they are delivered into piles, ready for loading on cars. The mill is so arranged that it can be changed at once from rails to billets, so that even the time generally lost in changing rolls can be utilized to turn out different sections of rails. The mills are also so arranged that billets and rails can be rolled at the same time, alternating with each other.

The next object of interest to the foundrymen was the new blast furnace plant, with its four stacks standing in a row, and the long line of blast stoves next to them. After passing through the boiler house, in which waste gases from the furnaces generate steam in 40 boilers, the visitors next reached the power house where were discovered 10 large blast engines, making a formidable array of ponderous machinery. The furnaces were then inspected, one after another, and three were seen in operation, while the preparations being made to start the fourth were shown.

After leaving the blast furnace plant the foundrymen separated, some going to look into the methods of charging, others going through casting houses, and the remainder scattering over the ore and coke yards, where great piles of ore and fuel are to be found. Above the stacks of ore and fuel were to be seen the great Brown hoisting and conveying machinery, which takes such an important part in the unloading of ore vessels.

Some of the members were taken over the new open hearth steel works and plate mill, which is an extremely large plant, and completely independent of the other buildings of the company. If erected as a separate enterprise this would, in itself, command attention from those accustomed to large institutions. On account of the depression in the iron trade, work on this plant has progressed slowly, but only a few more weeks will be required before it is completed. One of the finest and largest plate mills in the world will then be the property of the Illinois Steel Co.

The company's laboratory is in the immediate vicinity of the plate mill, in a fire-proof structure. A good many of the party present were taken through this laboratory, which is one of the most modern equipped to be fouud; and in view of the increasing interest taken by the foundry trade in the application of chemistry to foundry practice, the laboratory was of very great interest to those who visited it. There was very little time, however, for the inspection of the apparatus in the laboratory, and a very brief discription of the manner in which the chemist is called upon during the several stages of the manufacture of sleel, was made to suffice.

It was the intention of the steel company officials also to show the foundrymen the manner in which a heat is taken from a blast furnace; it was found, however, that this operation could not take place until five o'clock, and as that was the time set for the departure of the guests to the city, it was impossible for them to see it.

At five o'clock the car that brought the visitors to the works was backed down on the tracks in the yard, and they embarked for the return trip to the city. All of those present expressed themselves as being delighted with their trip, and many were the thanks which were extended to Maj. Pickands for the instruction and entertainment furnished during their stay at the works.

THE ASSOCIATION AT DINNER.

A previous arrangement had been made for a dinner in the evening, for the members of the Association and their friends, and accordingly at 7 o'clock the foundrymen gathered at the Palmer House, where nearly 60 covers were laid. A very excellent menu was served and after the last course had been

disposed of, President Geo. M. Sargent called for order, and introduced the post-prandial exercises by a graceful speech, in which he enlarged upon the flattering prospect for the success of the Association, referred to the pleasant manner in which the afternoon had been passed, and welcomed the members and friends he saw around him. The following resolution was then presented by Mr. Sercomb, and was unanimously carried:

"*Resolved*, That the Western Foundrymen's Association and the gentlemen present extend to Messrs. Pickands, Brown & Co. their most sincere thanks for the delightful and instructive trip enjoyed to-day through their generosity; and also to the Illinois Steel Co. for showing us through their works at South Chicago."

President Sargent then introduced the program of the evening. "We had a nice trip this afternoon," he said, "and went to work in just the right way. Everybody was introduced to everybody else. We have seen a great deal that is of interest and gathering around these tables has certainly promoted good fellowship. This is the first dinner that we have taken as an Association. Mr. Potter has very kindly prepared a paper which he will read this evening."

"I feel very highly flattered," Mr. Potter responded, "to read a paper at your initial dinner. At the request of your Secretary I have prepared a paper on "The Blast Furnace," as a subject which would be of great interest to foundrymen. In the paper that I have prepared I have endeavored to put the subject in the simplest manner and to avoid anything like technicality. In preparing it I may possibly have omitted some details, and I should be glad to discuss with you any suggestions, or any questions that you care to ask." [The paper is given in full in another column.—ED.]

After the reading of Mr. Potter's interesting paper, President Sargent called upon a number of the gentlemen present, and responses were made as follows, every taking point being accented with applause:

Mr. E. A. Wheeler, Sharon, Pa.—I want to thank you for the pleasant afternoon spent with you. When I received the invitation to visit the works of the Illinois Steel Co. I decided at once to come. I have visited other steel works and, of course, am interested in them. I think we are all better for spending this afternoon together at the works. When I see a locomotive hitched to a long train and the engineer step aboard and pull the throttle and the train move on, I think it is a thing of admiration to see what brains will do when rightly directed. A man's brain moves the whole train. It is so with the steel works. We saw the ore loaded with a steam shovel, and no hand was touched to it; pushed up by a locomotive; raised on a hoist with steam power; put into the furnace; run into pigs; carried down by steam engine; and blown and converted into ingots without anyone touching it. The ingots were put into a soaking-pot to take from them the lateral heat; taken out; run into rails 90 feet long and then sawed into lengths. The only time I saw them handled was when a man with a file smoothed off the ends. The rest was the work of brains.

Now, gentlemen, it is said there is nothing new under the sun; but I tell you there is. The Bessemer process is new. It is one of the grandest discoveries made in the iron business. And while Sir Henry Bessemer brought this invention out, it was a mere accident. Mr. Bessemer thought he had completed the process and gave out licenses to use it. He had been fortunate in getting some very nice iron and it made fair steel, but the chemical analysis of iron was then almost unknown. He gave out licenses to other Englishmen but when they came to manufacture under them, it was a complete failure and he was denounced as a fraud. Just at this time he employed as a chemist, George Mushet, who analyzed the metal. He found it must be comparatively free from phosphorus and very nearly free from sulphur. Mr. Bessemer's process was to blow the iron and burn out the silicon and carbon to such an extent as to just leave enough to have a steel mixture, but he did not know when to stop blowing. Mr. Mushet's idea was to blow it until the silicon and carbon were all burnt out, and then to add metals containing the required elements, thus enabling one to know the exact amount of carbon contained. I have always felt that Mr. Mushet did not have the credit he deserved in bringing out the process. The Bessemer process should be called the Bessemer-Mushet process. Mr. Mushet should have received his share of the credit. Although Mr. Bessemer pensioned Mr. Mushet for his natural life-time, he never gave him the honor of helping to invent the process. That was the commencement of using a chemist in connection with a blast furnace and from that day on great strides have been made in the iron business, and the only party engaged in the iron business that has not been benefited by chemistry is the foundryman, who still depends on judging iron by the fracture. This is not the right way to do, as the fracture does not show the quality of the iron. Only to-day a gentleman showed me a long list of irons ranging from 1¼ per cent silicon to 3½ per cent. I think I could select from his line a mixture that would suit any foundryman, and I can do it a great deal better than any one can by the fracture. I hope to see the day when foundrymen will order iron by analysis without any regard to fracture.

Capt. R. W. Hunt.—The reference that has been made to chemistry touches me very deeply and in a tender spot, as my early connection with the iron business was that of a chemist, and has been more or less all my life, and I am impressed with the importance of the chemist and his practice in connection with iron business. I know how young your Association is. I have followed your meetings with the greatest of interest as reported in the trade papers, and have read many discussions on papers that have been presented to you with great interest and profit, and I think the best evidence that you all feel the same way is the success of your first annual meeting. I feel confident when I wish you every success in the future that I am not visionary, because it has already been achieved by you. The Bessemer process has been alluded to by the last speaker. Its history has been a remarkable one and it has been such a short one that it surprises us that any such thing should be accomplished in one life-time. It was comparatively the other day that it was an experiment. In 1865 the first Bessemer steel was made in Wyandotte, Mich., in small experimental works. From that humble beginning came those great works which you have visited this afternoon.

There were two claimants for the invention: Sir Henry Bessemer in England and William Kelly in America. Two companies were organized which were working against each other. Capitalists could not be induced to look upon the process as more than a curiosity and possibility in the future. Eventually the capitalists interested on both sides saw that if it was to be a success they had better pool their interests and own all the patents and this was done.

When you notice the machinery moving so smoothly without human hands apparently touching it, you little imagine the difficulties and uncertainties that existed during the experiments. The pig was put into the cupola. The cupola as applied to the Bessemer industry is an American adaptation. In all foreign countries except Sweden, the iron is melted in reverberatory furnaces. It took some three or four hours to melt the charge, and it was an English engineer that suggested experimenting with the iron in the furnace. It was not entirely successful, owing to the cupola being very small, but it was successful enough to prove that it could be done if proper space be taken and proper cupolas built. The proportion of fuel to iron was brought down less and less until it has reached the present point. The cupola to-day in the Bessemer practice melts about 1 to 11. Of course this is way beyond anything you reach in your foundry practice. The cupolas are very large and run the best part of a week.

Mr. Potter referred to the danger in operating a blast furnace. I never hear of danger of that kind without thinking of that bright light who yielded up his life to the blast furnace. I refer to my old friend Capt. William R. Jones. It has been said that this was perhaps another instance of a general being shot in the picket line, because he was not absolutely called upon to be at the post of danger. But he was very constant and devoted to his duties and to the interests of his employers and could not be happy unless he was present to get the furnace out of any difficulty. The result was a slip of the stop or something and the furnace broke out just above the middle and a great blast came out and he yielded up his life. Capt. Jones and I were thrown together a great deal in the early days. We were making iron rails and thought 100 tons in twenty-four hours was pretty satisfactory work. To-day they were making 2,500 tons without anybody touching

the metal. This has all been brought about by the application of thought, brain, science and chemistry. They are succeeding in getting the product much more cheaply than it was formerly thought possible, and making a good product, too. They may say that it is not as good as we had in the olden times, because it is made of much poorer material and is of inferior quality. Quite the opposite. We can take the cheaper and poorer material and make the better product, just as we take the poorer individual and make a better man. I am delighted, gentlemen, that you are so seriously turning your attention to the study of your particular business. It is impossible for the smaller establishments to have all the advantages of the larger ones, but coming together as you do and comparing notes, you absorb these results which are obtained in the greater establishments. I think you will agree with me that nothing has done more to elevate and make possible the results that have been gained in the world than just such associations as your own. It has been personal thought and experience that has helped, and in helping another the individual himself has been helped, because two men cannot come together and compare ideas without helping each other. It is never good to build a Chinese wall around us. While a man has got himself housed inside of it, he is unable to look out and becomes as narrow and contracted as the limits of the wall.

Maj. McDowell.—I like the remarks that have been made here tonight on the subject of chemistry. Is it not possible for us in the foundry to have the appliances similar to what the Bessemer plant has? Capt. Hunt says it is the cheapest way to melt iron. I look forward to the day, gentlemen, when the foundryman will make a good iron casting and he will have the appliances that will enable him to make the iron with the same accuracy that the steel man does. He will have the material and will call upon the chemist to give the analysis, and then he will know just what to use to bring about the desired results. I am looking forward to that day and working to that end when foundry practice will be of such a nature that a foundryman will know and can go back and reproduce the same thing that he did the day, month or year before.

The Bessemer process came at a time when there were great changes going on in the iron business. At that time it used to take a man and his helper all day long to make one charge and it was pretty poor iron at that. Sometimes it had to be done over two or three times. Machinery now does in a much less time what we did in a long time. It is overcoming evil with good. We get the metal in the right condition. We do not have to labor ourselves. We know the conditions we want and get a chemist to tell us how to do it. I tell you there is nothing like having an application of science added to our practical works and then we will surely have success with the article we want to make. (Applause.)

Mr. Geo. W. Cope responded with a couple of well turned stories and then in more serious vein paid tribute to the foundryman's part in all that excited the wonder and interest of the party of the afternoon: As I have been listening to the suggestions I have been deeply interested in the fact that while we were down at the steel works and witnessing the wonderful things that were being done there, one could not help asking where would all that machinery have been if it had not been for the foundryman? There is where he comes in. All the work that is done down there is started by the foundryman. I think you can have a great deal of pride in the fact that notwithstanding the great geniuses that have developed the Bessemer process, it would not have amounted to a great deal but for the foundryman.

Maj. Pickands.—I am entirely in sympathy with this meeting and its objects. It is a wonder to me that so intelligent a body of men should have waited until this late day to gather together and form an association and exchange ideas with each other. Some thirteen years ago I was making iron in the Lake Superior region and I suddenly got results that astonished me. I was making No. 1 iron and a white spot appeared in the fracture of the pig; otherwise it was an open No. 1 iron. I could not, in my own mind, locate the reason and found a chemist and had him analyze it. Then I wrote to a friend of mine who was a metallurgist. He said the white spot was caused by want of silicon. That was the first I knew that low silicon would cause a white spot in iron. But it was true. I took the question of silicon in iron up that moment. When the foundryman is buying iron he ought to know what he is getting. I think you will find in this Association that in comparing notes as you do and learning all you can on the subject of iron you will advance in your individual business, and as well advance the profession as a profession. The foundry trade will come to the front and be one of the foremost interests in the country.

Mr. Potter.—I do not want to do all the talking, but the remarks of Maj. McDowell remind me that I was once a foundryman. When the Bessemer process was first started at South Chicago we were very anxions to have a foundry for making our ingot molds. The powers that be wanted to be economical and said if I could build a foundry for $2,500 I might do it. The money gave out and I did not have a cupola and the only thing I could think of was to blow the metal in the converter. It took two heats of the converter to make the ingot molds for the steel works. We ran our foundry after that without a capola. I think it had been tried before and I know that the thing can be successfully done, and I know you can get any kind or grade of iron in the Bessemer converter. That opens up a very large field in foundry practice.

Mr. Sercomb.—We are all business men. We are hustling for business. But our trip this afternoon has done us good. I am much pleased with the gathering to-night. I see many strange faces here and I want you to put in your application for membership. It will help you and it will help us. We need just such an organization. As I look around I see you are all representative men and every one is capable of getting on the floor and expressing himself in a proper manner. Come forward to-night and join us.

Mr. Moore.—In going over the works of the Illinois Steel Co. there was constantly in my mind this fact: that we saw ore that was bought by the ton and paid for by chemical analysis; it is put in the blast furnace with coke that is analyzed; lime stone is put in, that is analyzed; out of the furnace comes slag that is analyzed; from the top of the furnace comes gas and that is analyzed; the furnace is lined with brick, and that is analyzed; the iron that comes from the furnace is analyzed; and when the casting is taken from the mixture, that is analyzed. While they were pouring these melts a test was taken, and that test ingot has a physical test, and it has a chemical test before it is cut into rails. Through the whole process, the laboratory is the key to the situation. From the standpoint of a foundryman, it seems to me that there is nothing that can engage your attention so important as this matter of chemical analysis of iron. The steel men employ the chemist from necessity; they cannot exist without him. The foundryman has not employed him because he has not been a necessity. Mr. Bessemer was saved and his business was saved by the use of a chemist and it seems not impossible to me that the man who is successful in the foundry business will be so by the application of chemistry to his every-day foundry practice. There can be to my mind no better purpose of the Association than to take up this subject of chemistry until we are thoroughly conversant with it. I know there are things that can be done by the aid of a chemist that a few years ago were thought impossible. I trust the lessons we have learned and the words of advice that have been given us by those who have a broader knowledge of metallurgy will be taken home by every one of us. I feel very deeply indebted to those who have come and given us the advice.

Mr. Snow.—One of our prominent manufacturers retired from active business and yet he did not want to give up entirely, so he had a little room fitted up for his own use. He was sitting in his office one day and he heard the engine making a great noise. He went out to see what the noise was about. "John," he said, "what is the matter with the engine?"

"I don't know, sir. We have sent for every one we know of in town but they cannot find out what the matter is."

At last it was decided that there was one man in town that had not been tried and he was sent for. He came in and sat down and looked at the engine for a short time and then put his finger on something, and told them to start it up as he thought it was all right. It proved to be true. A little later he sent in his bill which read: "One hour's work, $.50; knowing how, $25." The man paid the bill without a word and said he paid it quicker than he ever paid a bill before. I want to join this Association so as to "know how." I can pick

up lots of knowledge here that I cannot gain in any other way. We are all in business to make money and it will help us all the more to get together and compare notes. We will find out then that we can do better by helping each other than by cutting prices to get the business away from another man. The first thing we know we will be friends rather than competitors.

Mr. Sorge.—In regard to the remarks made by some of the gentlemen on the value of chemistry, I can simply say that we are using it every day. We are applying it just as closely as we can. In purchasing iron I insist upon purchasing from analysis. I mix my iron entirely from analysis. I know that we can produce to-morrow just what we produced—I will not say a year ago, for I have not been with Fraser & Chalmers that long—but certainly three months ago. I have tried it repeatedly for the year past and I know we have duplicated results which had been produced several months before. It is simply by the application of chemistry.

Mr. Sweeney.—We have heard from gentlemen who are the exponents of the highest possibility of iron—Bessemer steel. Naturally we do not expect to follow out their process, but there are great changes taking place even in the foundry practice. The benefits of the Bessemer process to the foundryman have been far-reaching. I have been from the beginning of this Association in favor of the introduction of chemistry into foundry practice. I have talked of it so much that at times I have thought I would be considered a bore. If you will stop and think, the brains, the science and chemistry of which Capt. Hunt has spoken this evening are what has advanced the steel men and should advance the foundrymen. It is quite important for the foundryman, not only to know what chemical ingredients he puts into the cupola, but as well what he puts out. It is a matter of importance that all should know what is in their casting. It will pay to investigate the subject of chemistry in the foundry.

Mr. C. P. Wheeler.—I was very glad of the opportunity to take you down to South Chicago and was glad of your desire to go, because becoming familiar with the method of making iron and steel will undoubtedly be of great benefit to you. There have been great changes in the production of iron for years past, and there will be greater ones growing out from the use of chemistry. When we know what the foundrymen want we will be better able to meet their requirements. They often come and do not know what they want. The speaker told a good story, which brought him to the point that what foundrymen need is system.

A resolution of thanks to Mr. Potter for his excellent paper was passed, and the first dinner of the Western Foundrymen's Association was over. It was voted by every attendant a complete success.

MAJ. MALCOLM MCDOWELL, of the McDowell Steel Co., Chicago, has just returned home from Philadelphia, where he has successfully introduced his process for making the McDowell semi-steel into the foundry of the I. P. Morris Co., which is the foundry department of Wm. Cramp & Sons. After severe tests made by the foundry superintendent and government officials, it was found that this metal met with the requirements of the foundry, and also of the government inspection. It is a metal made in the cupola from No. 2 foundry coke iron as a substitute for charcoal pig melted in a heated air furnace.

A PAMPHLET of facts concerning the Standard scales, manufactured by the Standard Scale & Supply Co., Ltd., of Pittsburg, has been sent out by the company. It contains fac simile letters from purchasers of track scales and other scales manufactured by this company, telling of their accuracy and their adaptation to the requirements of heavy manufacturers and shippers. Various furnace companies and steel and iron works are included in the number. A point is made by the Standard company of the fact that it is not controlled by any combination or trust. The works are at Bellefonte, Pa.

THE Andrews & Hitchcock Iron Co., of Youngstown, are not building a new furnace at Hubbard, as has been stated in daily newspapers, but are repairing their No. 2 furnace. The Warren (O.) Boiler Works have the contract for part of the work.

PERSONAL.

J. F. Holloway, of New York, has an article in *Cassier's Magazine* for October dealing with the Engineer's Club of New York City—an organization of vigorous growth, made up of prominent engineers in the various branches of the profession in all parts of the United States. Views of various rooms of the club are given in connection with the descriptions and the artist has given to the lay figures, disposed in various positions, the faces of well known engineers belonging to the club.

Arthur Holland announces under Pittsburg date that he has retired from Naylor & Co. On Oct. 1 he opened an office in the German National Bank Building, Pittsburg, and will pursue the same business as before under the name of Holland & Co. Naylor & Co., in announcing Mr. Holland's retirement, say that their Pittsburg office will be continued in the Lewis Block.

G. L. Luetscher has been appointed superintendent of the open hearth department of the Otis Steel Co., Ltd., of Cleveland.

F. W. Denton, formerly of the mining school at Houghton, Mich., has accepted the position of engineer with the Minnesota Iron Co., at Tower, Minn.

E. J. Skinner, secretary of the Skinner Chuck Co., of New Britain, Conn., was a caller at the office of *The Iron Trade Review* the past week.

H. Duvall, secretary of the Weston Furnace Co., of Manistique, Mich., was in Cleveland the past week. Weston Furnace will run until material now on hand is worked up and will then close down to await a turn for the better in the market for charcoal iron.

Get the Scale off the Steel.

A good many dies and cutters are hardened without having been planed or turned off sufficiently to entirely remove the scale. The result is usually that a die is said to harden in spots, or the teeth of a cutter are not hard enough to hold their edge. The piece is often reheated, and perhaps cracked, and then the steel is condemned.

There is no economy in trying to save an extra cut of 1-32 or 1-16 inch (according to the size of the piece) in finishing a die block or cutter blank, and running the risk of losing all work laid out by poor hardening. If the scale is thoroughly removed the steel will harden all over at the proper heat, and a tool made which will repay, many times over, the slight extra time and labor bestowed on it. The amount of stock turned off is trifling in value compared with the superior durability of the finished tool.

The allowance, or want of allowance, of ample stock for finishing to a given size has often been brought to the notice of steel users by the steelmakers of this country and England, but the subject has not received the attention it deserved. Yet there are men who assume to decide on the quality of steel and its capacity for hardening by testing the end of a bar hardened with the scale on, and condemning such as could be touched with a file on the outside of the scale, not knowing, or forgetting, that the outside of a bar is not steel at all but oxide of iron—others will not take off enough to finish properly because they believe the best wearing stock is on the outside.—[Sparks from the Crescent Anvil.

THE steamship Northwest has made her last trip, arriving at Buffalo on the 25th. The forest fires interfered with traffic in Minnesota so that the vessel was taken off sooner than had been intended. It is said that her net receipts for the season have been $40,000, which is $10,000 more than the interest on her cost. The vessel made 16 trips and carried 8,300 passengers in the season.

IN the *Century* for October is an editorial consideration of the question "Is Bimetallism Desirable?" by the writer of the previous articles on Cheap Money Experiments, which have appeared in this department. There is also a paper on "The Nation and Its Toilers" in continuation of the articles on the American Laboring Class, published in the same department last year.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

The Opaque Shade Cloth Co., West Pullman, Ill., wants to buy a second-hand h. p. horizontal engine; must be almost new.

Robert E. Hills, 57 N. Wells St., Chicago, wants to buy a second-hand power pipe cutter for cutting four inch pipe, and a second-hand engine, 24x32.

Cornell, Hiscox & Underhill, Richmond, Va., are in the market for a second-hand 36-inch or 38-inch swing engine lathe 10x12 feet between centers, in first-class condition.

The Quast Gas & Gasoline Engine Co., recently organized at Bucyrus, O., is in the market for machinery and supplies to equip its machine shop, wood-working department and foundry.

M. Hirschfield, Briggs House, Chicago, is in the market for the following machinery, new or second-hand, must be by good maker, and in first-class condition: one 13-inch engine lathe, one 16-inch engine lathe, one 20-inch drill press, one universal milling machine (small size), one 12-inch turret machine, one 10-inch turret machine, one 12-inch wire-feed screw machine, one 10-inch wire-feed screw machine, one small tapping machine, four small bench drill presses, five 10-inch hand lathes, one 15-inch shaper, one bolt cutter (No. 1 size), one large press about the size of Bliss 4½ or 5, one smaller press, one pipe cutting-off machine, emery stands, lathe chucks, bench vises, drill chucks, 6 and 9 inch box chucks, etc.

New Construction:—

The Keystone Bicycle Co., Weatherstone, Pa., will build a new bicycle factory in that place.

J. J. & J. B. Cole, of Asheville, N. C., will at once rebuild their machine shop and foundry, lately burned.

L. E. Hoyt & Co., Walton, N. Y., will shortly commence rebuilding their foundry, which was recently burned.

The Scottdale Iron & Steel Co., Scottdale, Pa., has commenced the erection of a new foundry building, 60x105 feet in size.

It is reported that the Anderson Iron & Bolt Co., of Anderson, Ind., will build a rolling mill to operate in connection with its plant.

The American Wire Nail Works of Anderson, Ind., are being enlarged by the addition of a structure 60x100 feet, to be used as a galvanizing room.

The plant of the new Youngstown Iron & Steel Roofing Co., Youngstown, O., has been completed, and the machinery was put in operation recently.

Armitage, Herschell & Co.'s new foundry at Buffalo, N. Y., is nearly completed, and is much larger and better than the one recently destroyed by fire.

The Midland Steel Co., Muncie, Ind., has begun the erection of another open hearth furnace, which was rendered necessary by the increasing business of the company.

Wright & Alford will build a new shovel factory at Anderson, Ind., where they have been promised free gas, land and a bonus on condition that they employ 200 hands.

Construction contracts have been let for the tin plate plant at New Lisbon, O., for which negotiations have been in progress lately, and it is hoped to begin making tin plate by Feb. 1.

The new plant of the Pittsburg Reduction Co., at Niagara Falls, will be ready for occupancy by December. Much of the machinery is in position. This plant has a much larger capacity than the old one at Kensington.

H. E. Collins & Co., of Pittsburgh, have received the contract for the construction of the iron buildings to be erected for the Keystone Rolling Mill Co., of Pittsburg, to take the place of the buildings recently destroyed by fire.

The Indiana Steel Casting Co., of Frankfort, Ind., whose partly completed works have been twice destroyed by cyclones, has closed a contract to erect a plant at Anderson, Ind. The company has an authorized stock of $200,000, and William Chambers is the manager.

It is reported that arrangements have been completed whereby the Dunkirk Locomotive Works will build extensive shops at Dunkirk, Ind. If the projected plans are completed, the plant will be a large one, as no less than twelve large buildings are being contemplated.

A company has been formed at Anderson, Ind., which, it is claimed, will build the largest tin plate mills in the country. The projectors contemplate building a twelve-mill plant fully equipped for finishing bright and terne plates. The scheme is headed by Phillip Matter, of Marion, and C. J. Dorsey, of Anderson.

The new power house for the Bridgeport Traction Co., at Bridgeport, Conn., consisting of a dynamo room and a boiler room, will be of iron and brick, composite construction, designed and built by the Berlin Iron Bridge Co., of East Berlin, Conn. The dynamo room will be controlled by a traveling crane, furnished by the same company.

The Shiffler Bridge Co., of Pittsburgh, has several good contracts on hand. Among them are a cast house for the Poughpeepsie, N. Y., Iron Co.; tinning house for the Wheeling, W. Va., Corrugating Co.; large boiler house for the Bellaire Nail Works, at Bellaire, O.; boiler house for the Standard Axe & Tool Co., Ridgway, Pa.; sheet mills for Zug & Co., Pittsburg, and three large roofs for the Chicago General St. Railway Company.

Additions, Enlargements, Removals, Etc.:—

The National Foundry & Pipe Works, of Scottdale, Pa., will shortly erect an additional pipe mill which will have a capacity equal to the present one.

J. K. Williams, of Akron, O., has recently built an addition which will double the capacity of his machine shop. A large lathe for heavy iron work has been added recently.

Wm. Yates & Co., of Pittsburg, Pa., are erecting a corrugated iron building to be used as a general machine shop. The plant, when completed, will be equipped with modern appliances in every way.

Mackintosh, Hemphill & Co., of Pittsburgh, will build an extensive addition to their present plant, to be used for the manufacture of tin plate. The plant will be very complete in all its details, and will include twelve tin mills.

The Toledo Bicycle Works, of Toledo, O., have recently organized and are now making some extensive alterations and additions to their plant. They have just closed a contract with the Lodge & Davis Machine Tool Co., of Cincinnati, for an outfit of machinery for the manufacture of bicycles.

The Illinois Screw Co., now located at No. 50 South Canal st., Chicago, has concluded arrangements with the Chicago Heights Land Association whereby it is to remove its works to Chicago Heights. It will put up a building there of brick and stone, 75x175 feet with boiler and engine house attached.

The Lane & Bodley Co., Cincinnati, O., is erecting an addition to its machine shop, 40x147 feet, six stories in height. The company has prepared plans and specifications for an electric power generating plant, including motors, wiring, arc and incandescent lamps, and several direct motor driven machines.

Fires and Accidents:—

The Enterprise Machine Works, at Elyria, O., were completely destroyed by fire recently, with a loss of $10,000.

The building occupied by the Marble Cycle Works, at Plymouth, Ind., was recently struck by lightning, and badly damaged. One end of the third story was completely torn off, and the rain poured in through the gap, causing serious damage to valuable machinery.

Quite an extensive fire occurred at the South Chicago plant of the Illinois Steel Co. last week Wednesday, when one of the tanks used for storing the crude oil used in the power plant, was completely destroyed. For a time it looked as if the entire plant of the steel company might be destroyed, but the fire was got under control. The loss was $600.

General Industrial Notes:—

The Alcalde furnace at Rusk, Texas, owned by the State, was put in blast again Sept. 17.

The Birmingham Rolling Mill Co. contradicts the report that it will establish a tin plate mill.

The Walker Mfg. Co., of Cleveland, has filed a certificate of increase of stock from $175,000 to $500,000.

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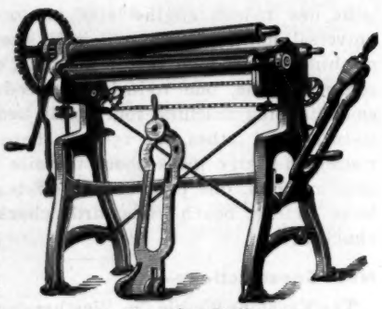

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The National Bolt & Nut Works of Reading, Pa., reduced wages of its 200 men from five to 15 per cent.

The Pittsburg Bridge Co. has the order for the steel roof trusses for the new station at Syracuse, N. Y.

Having no orders, the Lackawanna Iron & Steel Co. closed its mill at Scranton last week throwing idle 1,000 men.

At Baltimore, the Youngstown (O.) Bridge Co. was awarded the contract for the new Columbia avenue bridge at $16,279.

A start has been made by the Duquesne Forge Co., at Rankin, Pa., which has orders that will employ it for some time.

The Canton (O.) Bridge Co. has been awarded the contract for the erection of a bridge at Clendennin, W. Va., at a cost of $7,000.

H. Stephen & Co., iron and steel merchants of Philadelphia, have recently made an assignment. Assets $15,000, liabilities $9,000.

The Edinburg (Ind.) Foundry & Machine Co., assigned with assets, consisting of the plant, $100,000, and liabilities, $16,000.

The Adams Boiler Co., of Cleveland, is now at work on a 500 h. p. waste heat boiler for the Falcon Tin Plate & Sheet Co., at Niles.

The Moore Mfg. & Fdry. Co., Milwaukee, Wis., started work in its new plant at South Milwaukee, the first of the present week.

The Ohio Falls Car Mfg. Co., of Jeffersonville and Clarksville, Ind., has declared a quarterly dividend of 2 per cent. on preferred stock.

The Tassie Belle charcoal furnace and the pipe works of the New Birmingham (Tex.) Iron & Improvement Co. will probably be started up soon.

The New Albany Forge & Rolling Mills, at New Albany, Ind., have been leased by Joseph Joseph & Bro., of Cincinnati, who will put them in operation.

The Penn Iron Co., of Lancaster, Pa., posted a notice of reduction of puddlers' wages from $3 to $2.75 a ton. Other employes are reduced 8 per cent.

The Stirling Co., of Chicago, have closed a contract with the West Chicago Railway for 8,000 h. p. water tube boilers. This order aggregates nearly $100,000.

The Lake Shore Iron & Steel Co. has been incorporated in Chicago by Hugh J. O'Neil, Henry J. Benjamin, and Samuel F. Knox, with a capital stock of $20,000.

The Bellevue Foundry & Machine Shops, at Bellevue, N. Y., have been sold to Samuel R. James, at assignee's sale. The works are new and have never been operated.

Orders have recently been received by the Hendey Machine Tool Co., of Torrington, Conn., for 14 machines, 11 of which are to be Hendey Norton lathes to go abroad.

The works of the Walburn-Swenson Co., at Chicago Heights, Ill., have lately been equipped with electric cranes, and in other ways have had their efficiency increased.

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The new Greensboro Iron & Steel Co., of Greensboro, N. C., has elected Julian S. Carr president and D. C. Warddell secretary. The furnace will probably resume soon.

Fulton furnace of the Globe Iron Co., at Jackson, O., has started in after a long idleness. The furnace has a rated capacity of 20 to 24 tons of high silicon softeners.

The Girard (O.) Stove Co. has decided that unless the Youngstown Board of Commerce holds out some inducements to them to move they will keep the works in Girard.

The contract for furnishing and putting up the iron work of the new Pittsburg and Homestead bridge, now being built at Homestead, Pa., has been awarded to the Phœnix Iron Co.

The Morgan Engineering Co., of Alliance, O., has recently secured the order of the Fulton Iron Works Co., of St. Louis for an overhead travelling crane of 40,000 pounds lifting capacity.

The Stanley Rule & Level Co. are installing a system of cars and tracks at their works at New Britain, Conn., and have selected for this purpose the narrow gauge system of the C. W. Hunt Co., New York.

Negotiations are now in progress looking to the leasing of the Soho furnace of the Moorehead-McLeane Co., of Pittsburg, by a syndicate composed of an Eastern concern and two Pittsburg steel mills.

At Alliance, O., the American Steel Casting Co. started up its Bessemer department Monday, after an idleness covering four months. Work will be given to 100 men and orders on hand will run the plant four months.

The American Tube & Iron Co., of Youngstown, has orders in hand for several months' work. One order is for 18 miles of two-inch pipe, and another for 10,000 tubes. The report of the receiver just made includes a dividend of 10 per cent.

The Department of Railways & Canals, Ottawa, Ont., will receive tenders until Oct. 16 for supplying for the Canadian Government railroads: 1,000 tons of 50-lb. steel rails, 300 tons of 56-lb. steel rails, and 3,000 tons of 67-lb. steel rails.

Maris & Beckly, of Philadelphia, report much improved business. They have a number of orders on their books unfilled, among them one for a crane to go to Tokio, Japan, and a crane for the Murray Iron Works, Burlington, Iowa.

At Altoona, Pa., judgments amounting to $15,000 were entered last week against the Altoona Mfg. Co., manufacturers of engines and machinery. The plant is mortgaged for $54,000. Assets are put at $200,000 and liabilities at $125,000. Employes numbered 300.

John S. Connelly has retired from the Connelly Gas Engine Co., manufacturers of gas engines and motors at New Castle, Pa. All the patent rights are owned by the company, which will push operations, turning its attention to the manufacture of engines for pumping oil.

The Illinois Central has ordered eight passenger locomotives from the Brooks Locomotive Works and 10 freight loco-

motives from the Rogers Locomotive Works. The New York & New England Road has contracted with the Rhode Island Locomotive Works for rebuilding 15 locomotives.

The Link-Belt Machinery Co., of Chicago, has recently received the following orders for its standard water tube safety boilers: 1,200 h. p. for the Second Ave. Traction Co., of Pittsburg; 200 h. p. for the Reliance Bldg., Chicago; 450 h. p. for the Midland Hotel, Kansas City, and 400 h. p. for the Lehigh Valley Coal Co., West Superior, Wis.

Excursion Rates via Pennsylvania Lines to the West, Northwest and Southwest.

On Sept. 25 and Oct. 9, excursion tickets will be sold at ticket offices on the Pennsylvania Lines to points in Arkansas, Colorado, Idaho, Indian Territory, Iowa, Kansas, Manitoba, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma Territory, South Dakota, Texas, Utah and Wyoming. Tickets will be good returning twenty-one days from date of sale. For details apply to nearest Pennsylvania Line Ticket Agent.

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For Buffalo, New York and Boston, it is the fast train east on the Nickel Plate Road and carries through Palace Buffet Sleeping cars.

To the South at Low Rates via Pennsylvania Lines.

The last of the series of cheap excursions over the Pennsylvania Lines to enable land seekers and others to visit Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina and Tennessee have been fixed for Oct. 2, Nov. 6, and Dec. 4, also to points in the above states except Kentucky on Oct. 9th. Tickets will be sold to all applicants at principal ticket offices of the Pennsylvania Lines, and will be good returning twenty days from date of sale.

Excursion to Cleveland.

For the occasion of the State Conclave of Knights Templar, to be held at Cleveland, Oct. 3rd to 5th, excursion tickets at very low rates will be on sale from all stations on the Valley Railway, Oct. 2nd, 3rd and 4th, good returning to Oct. 6th, 1894, inclusive.

Try No. 5,

The fast train on the Nickel Plate Road for Chicago and all points west.

A remarkable reduction in rates has been made to points in the West for Sept. 25th and Oct. 9th. Ask agents of the Nickel Plate Road.

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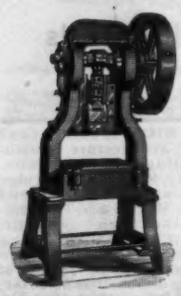

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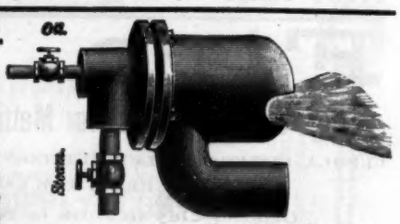

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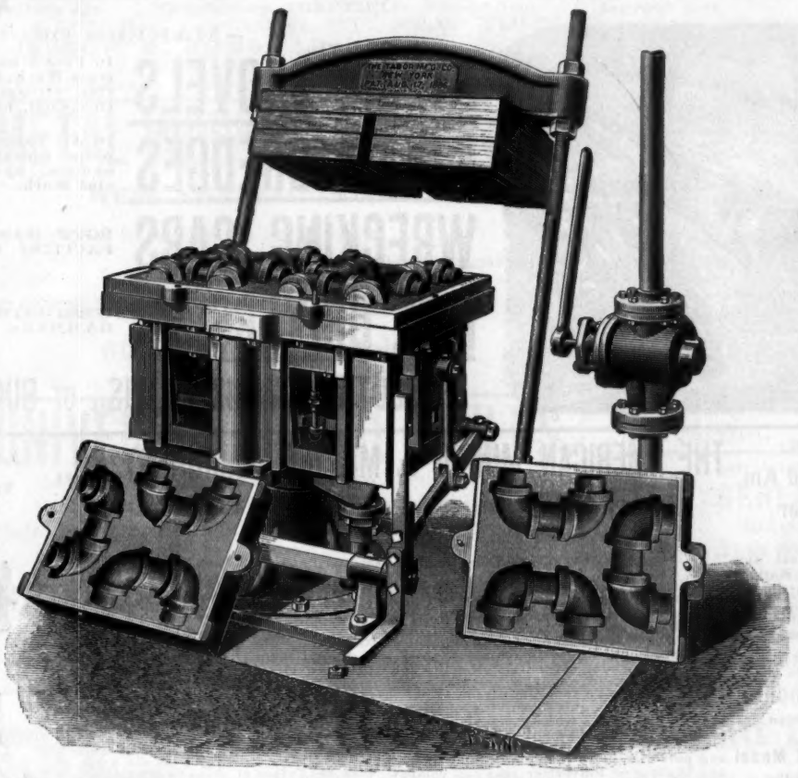

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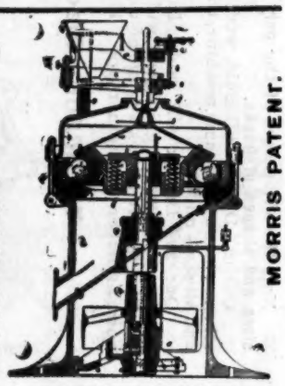

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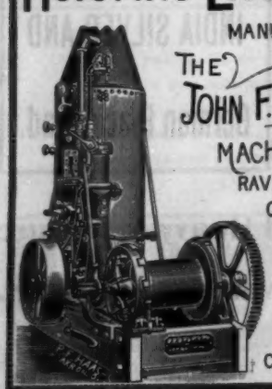

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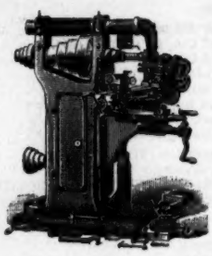

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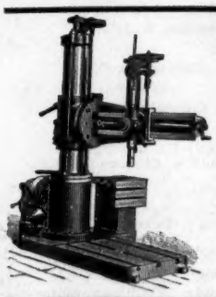

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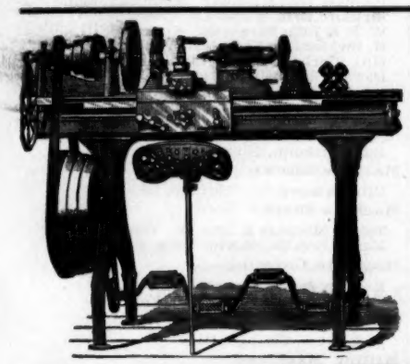

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Union Mining Co., Mt. Savage, Md.
Geo. H. Anderson & Co., Pittsburg, Pa.
Westmoreland Fire Brick Co., Pittsburg, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
American Fire Brick & Clay Co., Mineral Point, Ohio.
Reese, Hammond & Co., Bolivar, Pa.
Clearfield Fire Brick Co., Clearfield, Pa.
Milwaukee Fdy. Supply Co., Milwaukee, Wis.
Cleveland Facing Mill Co., Cleveland, O.

Fire Pails—
Thos. J. Bell & Co., Cincinnati, O.

Fire Proof Covering—
Keasbey & Mattison Co., Ambler, Pa.
Ed. Wertheim, Chicago.

Flue Scrapers—
Ed. Wertheim, Chicago.

Foot and Power Lathes—
Prentiss Tool & Supply Co., Chicago, Ill.
W. F. & John Barnes Co., Rockford, Ill.
Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.
New York Machinery Depot, 178 Broadway, New York City.
Lodge & Shipley Machine Tool Co., Cincinnati.

Foundries—
Harn, Ow & Co., Beaver Falls, Pa.
Brightman Stoker Co., Cleveland, O.
The Lloyd-Booth Co., Youngstown, O.
Taylor & Boggis Foundry Co., Cleveland, O.
Wm. Tod & Co., Youngstown, O.

Foundry Supplies—
Greiner Economical Cupola Co., Chicago, Ill.
American Fire Brick & Clay Co., Mineral Point, Ohio.
Clearfield Fire Brick Co., Clearfield, Pa.
Millett Core Oven Co., Brightwood, Mass.
Ohio Sand Co., Conneaut, O.
Milwaukee Fdy. Supply Co., Milwaukee, Wis.
Cleveland Facing Mill Co., Cleveland, O.
Tabor Mfg. Co., New York City.

Forgings—
Cleveland City Forge & Iron Co., Cleveland.

Fuel Oil Burners—
Thurman Fuel Oil Burner Co., Indianapolis, Ind

Furnace Linings—
Union Mining Co., Mt. Savage, Md.
American Fire Brick & Clay Co., Mineral Point, Ohio.
Milwaukee Fdy. Supply Co., Milwaukee, Wis.

Galvanizers—
H. H. Hodell & Co., Cleveland.

Gears—
Geo. B. Grant, 86 Seneca st., Cleveland, O.

Grindstones—
E. K. Morris & Co., Cincinnati, O.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City, N. J.

Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O.
Brightman Stoker Co., Cleveland, O.
Warren, Webster & Co., Camden, N. J.

Heavy Hardware—
E. K. Morris & Co., Cincinnati, O.

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C. W. Hunt Co., New York City.

Hoisting Engines—
The John F. Byers Machine Co., Ravenna, O.
C. W. Hunt Co., New York City.
Pen Argyl Iron Works, Pen Argyl, Pa.

Hot Water Heaters—
United States Heater Co., Detroit, Mich.

House Heaters—
United States Heater Co., Detroit, Mich.

Injectors—
Ed. Wertheim, Chicago.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Investments—
Frank R. Biedler, Baltimore, Md.
Fidelity & Deposit Co., Baltimore, Md.
Geo. Pemberton, New York.
Andrew Mayer, 18 Wall st., New York.

Iron Nails and Steel—
Weber & Co., Cincinnati, O.
G. B. Schulte Sons Co., Cincinnati, O.
Geo. H. Sibell & Co., Chicago, Ill.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.

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Oglebay, Norton & Co., Cleveland.
J. H. Outhwaite & Co., Cleveland.
Condit-Fuller Co., Cleveland.
E. C. Pope, Cleveland.
Geo. H. Sibell & Co., Chicago, Ill.
Forster, Hawes & Co., Chicago, Ill.

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Cleveland Twist Drill Co., Cleveland, O.
Prentiss Tool & Supply Co., Chicago, Ill.
Toledo Machine & Tool Co., Toledo, O.
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Fox Machine Co., Grand Rapids, Mich.
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Lodge & Shipley Machine Tool Co., Cincinnati.

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The Jeffrey Mfg. Co., Columbus, O.

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McCallip Fence Co., Columbus, O.

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Bickford Drill & Tool Co., Cincinnati, O.
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Ed. Wertheim, Chicago.

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Harn, Ow & Co., Beaver Falls, Pa.

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New York Machinery Depot, 178 Broadway, New York City.
Lodge & Shipley Machine Tool Co., Cincinnati.

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C. W. Hunt Co., New York City.

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Ohio Sand Co., Conneaut, O.
Milwaukee Fdy. Supply Co., Milwaukee, Wis.
Tabor Mfg. Co., New York City.
Cleveland Facing Mill Co., Cleveland, O.

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Oil Pumps—
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Jos. Dixon Crucible Co., Jersey City, N. J.

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Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Ltd., Carbondale, Pa.

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Bickford Drill & Tool Co., Cincinnati, O.
Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.
New York Machinery Depot, 178 Broadway, New York City.
Lodge & Shipley Machine Tool Co., Cincinnati.

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Millett Core Oven Co., Brightwood, Mass.

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Armstrong Bros., Springfield, O.

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Cady Mfg. Co., Cleveland, O.

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Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.

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American Mining & Milling Machinery Co. Cleveland, O.

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Totten & Hogg I. & S. F'dry Co., Pittsburg, Pa.

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Consolidated Roofing Works, Columbus, O.

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Correspondence School of Mechanics, Scranton, Pa.

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Harrington & King Perforating Co., Chicago.
Hendrick Mfg. Co., Ltd., Carbondale, Pa.

Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.

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Illinois Screw Co., Chicago, Ill.

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Dawson & Goodwin, Chicago, Ill.
New York Machinery Depot, 178 Broadway, New York City.

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Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Dawson & Goodwin, Chicago Ill.
Fox Machine Co., Grand Rapids, Mich.

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Berger Bros., Philadelphia, Pa.

Smoke Consumer—
Brightman Stoker Co., Cleveland, O.

Smokeless Furnaces—
Brightman Stoker Co., Cleveland, O.

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Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Lodge & Shipley Machine Tool Co., Cincinnati.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insuranc Co., Hartford, Conn.

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Ed. Wertheim, Chicago.

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Keasbey & Mattison Co., Ambler, Pa.
Ed. Wertheim, Chicago.

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Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.

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Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Castings—
Wm. Jessop & Sons, Ltd., New York, N. Y.

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Stokers—
Brightman Stoker Co., Cleveland, O.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.

Tanks—
R. Laird & Son, Galion, O.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tool Steel—
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Tramways—
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McCallip Fence Co., Columbus, O.

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C. W. Hunt Co., New York City.

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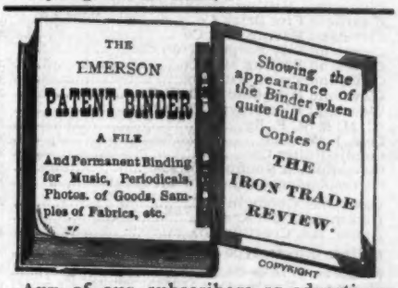

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Valley Ry. | Depot foot of So. Water St. City Office 143 Superior St.

	Arrive.	Depart.
Akron & Canton	*6:35 P M	*7:10 A M
Akron, Canton & Valley Jctn..	*10:10 A M	*3:15 P M
Valley Jctn. & Way Stations..	†6:35 P M	†7:10 A M
Akron, Canton & Chicago	*8:00 A M	*6:30 P M
Wooster and Garrett	†3:00 P M	†11:00 A M
Wooster	.....	*6:30 P M
Akron, Canton & Marietta	†3:00 P M	†11:00 A M
Steubenville, Wheeling, Washington, D. C., and Baltimore	†3:00 P M	†11:00 A M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule Drawing Room cars between Cleveland and Chicago.

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IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	3.00@ 3.35
No. 1 Bessemer hematite	2.75@ 3.00
Hematites No. 1 non-Bessemer	2.00@ 2.50
No 1. Specular, non-Bessemer	2.35@ 3.00

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$11 75@$12 00
No. 1 Strong Foundry	11 50@ 11 65
No. 2 Strong Foundry	10 50@ 10 75
No. 1 Gray Forge, red short	9 75@ 00 00
No. 2 Gray Forge, neutral	9 25@ 00 00
No. 1 American Scotch	11 65@ 00 00
No. 2 American Scotch	10 65@ 00 00
Lake Superior Charcoal	13 25@ 13 50

PITTSBURG:

No. 1 Foundry	$11 50@$11 75
No. 2 Foundry	10 50@ 10 75
Gray Forge	10 00@ 0 00
White and Mottled	9 00@ 9 25
Warm Blast Charcoal	18 00@ 19 00
Cold Blast Charcoal	22 00@ 26 00
Bessemer	11 75@ 12 00

CHICAGO (reported by our representative:)

Lake Superior Charcoal	$14 75@$15 25
Local Coke Foundry No. 1	10 25@ 10 50
Local Coke Foundry No. 2	10 00@ 10 25
Local Coke Foundry No. 3	9 50@ 10 00
Local Scotch Foundry No. 1	10 75@ 11 00
Local Scotch Foundry No. 2	10 00@ 10 50
Local Scotch Foundry No. 3	9 50@ 10 00
Southern Coke No. 1	11 75@ 12 00
Southern Coke No. 2	11 00@ 11 25
Southern Coke No. 3	10 50@ 10 75
Southern No. 1 Soft	10 75@ 11 00
Southern No. 2 Soft	10 50@ 10 75
Southern Silveries No. 1	12 00@ 12 25
Southern Silveries No. 2	11 50@ 11 75
Jackson Co. Silveries	14 50@ 15 00
Ohio Silveries No. 1	14 00@ 14 50
Ohio Silveries No. 2	13 00@ 13 50
Ohio Strong Softeners	13 00@ 13 50
Alabama Car Wheel	17 75@ 18 25
Southern Charcoal No. 1	15 50
Southern Charcoal No. 2	14 50
Southern Charcoal No. 3	14 00
Malleable Bessemer	10 75@ 11 25
Coke Bessemer	11 25@ 11 50

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$10 25@$10 50
Southern Coke No. 2 and No. 1 Soft	9 75@ 10 00
Hanging Rock Coke, No 1	12 00@ 12 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	14 00@ 14 50
Jackson County Stone Coal No 1	14 50@ 16 00
Southern Coke, Grey Forge	8 75@ 9 00
" " Mottled	8 50@ 8 75
Standard Alabama Car Wheel	16 25@ 17 25
Tennessee " "	15 50@ 16 00
Lake Superior " "	16 00@ 16 50

BUFFALO (reported by Rogers, Brown & Co.)

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$11 75
No. 2 Foundry Strong Coke Iron Lake Superior Ore	11 25
Ohio Softener No. 1	12 25
Jackson Co. Silvery No. 1	15 75@ 16 75
Lake Superior Charcoal	14 00
Tennessee Charcoal	15 50
Southern Soft No. 1	11 75
Southern Soft No. 2	11 25
Alabama Car Wheel	16 00@ 17 50
Hanging Rock Charcoal	18 50

LOUISVILLE (reported by Geo. H. Hull & Co.)

Southern Coke No. 1 Foundry	$10 00@$10 50
Southern Coke No. 2 Foundry	9 25@ 9 50
Southern Coke No. 3 Foundry	8 75@ 9 00
Gray Forge	8 50@ 8 75
Southern Charcoal No. 1 Foundry	12 50@ 13 50
Car Wheel	15 00@ 15 50
Spathite	11 25@ 11 75

ST. LOUIS (reported by Rogers, Brown & Meacham):

Southern Coke No 1	$11 00@$11 25
Southern Coke No. 2	10 25@ 10 75
Southern Coke No. 3	9 75@ 10 00
Southern Gray Forge	9 50@ 9 75
Southern Charcoal No. 1	14 00@ 14 50
Missouri Charcoal No. 1	13 00@ 13 55
Ohio Softeners	14 00@ 14 50
Lake Superior	16 00@ 16 50
Southern	16 75@ 17 20
Connellsville Coke, St. Louis	5 00

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	GROSS TONS
Old iron rails	$12 00
Old steel rails	10 00
	NET TONS
No. 1 R. R. wrought scrap	$ 9 00
No. 1 wrought scrap	8 50
No. 1 Machine cast scrap	8 50
Iron axles	15 00
Axle turnings	8 00
Wrought turnings (free from cast)	6 50
Cast borings	4 75
Uncut wrought iron boilers	3 00
Steel boiler plates	8 00
Grate bars	4 00
Pipes and flues (clean)	7 00
Tank iron	6 00
Hoop and band iron	5 00
Sheet iron	5 00
Wrought drillings	6 00
Malleable iron	7 00

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LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.

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OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

Splice Bar Punch. (1)

—THE—

Long & Allstatter Co.

HAMILTON, O., U. S. A.

Manufacturers of Belt, Steam and Electrically driven

POWER PUNCHES and SHEARS,

for all kinds of Boiler, Tank and Structural Iron Work, Rolling Mills, Locomotive Shops, Car and Wagon Shops, Plow Shops, etc. Send for Catalogue.

A. H. LEITCH, PRES JOHN C. LEITCH, SEC. AND GENL. MAN. JOHN A. WILSON, TREAS.

WESTMORELAND FIRE BRICK CO. MANUFACTURERS OF HIGH GRADE FIRE BRICKS.

PITTSBURG, PA.

Works and Mines, Westmoreland, Pa.

DIXON'S PERFECT LUBRICATING GRAPHITE.

The most Marvelous Lubricant Known.
Used Dry, or Mixed with Water, Oil or Grease

NOT AFFECTED BY HEAT, COLD, STEAM OR ACIDS.

An Interesting and Instructive Pamphlet will be sent Free of Charge.

JOS. DIXON CRUCIBLE CO. Jersey City, N. J.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g,
CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. mill)	1.25c@1.35c
Angles	1.20c@1.25c
Tees	1.35c@1.45c
Universal Plates	1.20c
Sheared Plates	1.30c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 30
4¼ to 6 by ⅜ to 1 inch	1 35
1¼ to 6 by 1¼ to 2 inch	1 50
1¼ & 1⅜ by ⅜ to ¾ inch	1 35
1 & 1¼ by ⅜ to ¾ inch	1 40
⅛, ¼, ⅜, by ⅛ to ⅜ inch	1 50

Round and Square.

1 to 1⅜ inch	1 30
2 to 2¾ inch	1 40
2¾ to 3¼ inch	1 55
3⅜ to 4 inch	1 80
4¼ to 4½ inch	2 40
4¾ to 5 inch	2 60

Oval.

⅜ to 1¼ inch	1 50
⅜ to ¾ inch	1 50
½	1 70
⅝	1 90

Half Oval and Half Round.

1¼ to 3 inch	1 85
⅜ to 1¼ inch	1 65
⅜ to ¾ inch	1 90
⅝	2 05
⅞	3 15

Heavy Band.

1¾ to 6 by ¼ and 5-16 inch	1 40
1 to 1⅜ by ¼ and 5-16 inch	1 45
¾ to ⅞ by ¼ and 5-16 inch	1 55
½ to ⅝ by ¼ and 5-16 inch	1 80

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 85
1 7-16 to 2, No. 17, 18 and 19	1 90
1 7-16 to 2, No. 20	2 00
1 7-16 to 2, No. 21	2 10
1 7-16 to 2, No. 22	2 20
1⅛ to 1⅜, No. 13, 14 and 15	1 90
1⅛ to 1⅜, No. 16, 17 and 18	1 95
1⅛ to 1⅜, No 19 and 20	2 00
1⅛ to 1⅜, No. 21	2 10
1⅛ to 1⅜, No. 22	2 20
15-16 and 1 inch, No. 13, 14 and 15	1 85
15-16 and 1 inch, No. 16, 17 and 18	2 00
15-16 and 1 inch, No. 19 and 20	2 10
15-16 and 1 inch, No. 21	2 30
15-16 and 1 inch, No. 22	2 30
⅞, No. 13, 14 and 15	2 10
⅞, No. 16, 17 and 18	2 30
⅞, No. 19 and 20	2 30
⅞, No. 21	2 40
⅞, No. 22	2 50
13-16, No. 13, 14 and 15	2 20
13-16, No. 16, 17 and 18	2 30
13-16, No. 19 and 20	2 40
13-16, No. 21	2 50
13-16, No. 22	2 60
¾, No. 13, 14 and 15	2 30
¾, No. 16, 17 and 18	2 45
¾, No. 19 and 20	2 55
¾, No. 21	2 65
¾, No. 22	2 75
11-16, No. 13, 14 and 15	2 55
11-16, No. 16, 17 and 18	2 60
11-16, No. 19 and 20	2 70
11-16, No. 21	2 80
11-16, No. 22	2 90
11-16, No. 23	3 00
⅝, No. 13, 14 and 15	2 60
⅝, No. 16, 17 and 18	2 70
⅝, No. 19 and 20	2 80
⅝, No. 21	2 90
⅝, No. 22	3 00
⅝, No. 23	3 10
9-16, No. 13, 14 and 15	2 80
9-16, No. 16, 17 and 18	2 90
9-16, No. and 20	3 00
9-16, No. 21	3 10
9-16, No. 22	3 20
9-16, No. 23	3 30
7-16 and ½ inch, No. 13, 14 and 15	3 00
7-16 and ½ inch, No. 16, 17 and 18	3 10
7-16 and ½ inch, No. 19 and 20	3 20
7-16 and ½ inch, No. 21	3 30
7-16 and ½ inch, No. 22	3 40
7-16 and ½ inch, No. 23	3 50
⅝, No. 13, 14 and 15	3 50
⅝, No. 16, 17 and 18	3 60
⅝, No. 19 and 20	3 70
⅝, No. 21	4 00
⅝, No. 22	4 10
⅝, No. 23	4 25

Light Band.

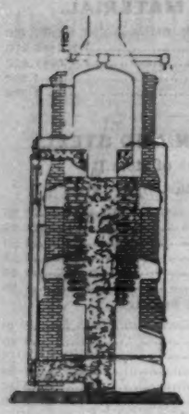
1¼ to 6 by ⅛ to 3-16 inch	1 60
1¼ to 6 by Nos. 11 and 12	1 65
1 to 1⅜ by ⅛ to 3-16 inch	1 65
1 to 1⅜ by Nos. 11 and 12	1 70
⅞ and 13-16 by ⅛ to 3-16 inch	1 80
⅞ and 13-16 by Nos. 11 and 12	1 85
¾ and 11-16 by ⅛ to 3-16 inch	1 90
¾ and 11-16 by Nos. 11 and 12	1 95
⅝ and 9-16 by ⅛ to 3-16 inch	2 05
⅝ and 9-16 by Nos. 11 and 12	2 10
½ by ¾ to 3-16 inch	2 20
½ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅝ inch, beveled edge, by Nos. 11 and 12	1 80
⅝ inch, " " " " 13 and 14	1 90
¾ inch, " " " " 11 and 12	1 95
¾ inch, " " " " 13 and 14	2 15

Sheet Iron.

No. 10	1 85
No. 12	1 90
No. 14	1 95



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WATER TUBE BOILER.

This Boiler is absolutely safe from explosion. Gives as much steam from the waste heat as any boiler made. Easy of access for cleaning and repairs. Furnishes perfectly dry steam. Occupies little ground space. Economical in first cost. Send for complete circulars giving list of users and testimonials, one of which is printed below.

The Falcon Tin Plate & Sheet Co.,
NILES, O., Aug. 18, 1893.

Chas. P. Adams, Esq.

Dear Sir: The three boilers of 225 H. P. each which you furnished us are working in every way satisfactory. We consider them as good steamers as any we have ever used. Up to the present time have spent nothing on them for repairs. Very respectfully,

THE FALCON TIN PLATE & SHEET CO.,
By Warner Arms, Pres't.

C. P. ADAMS.
807 The Cuyahoga, - CLEVELAND. O.

C. W. HUNT COMPANY,

THE HUNT TIP CAR.

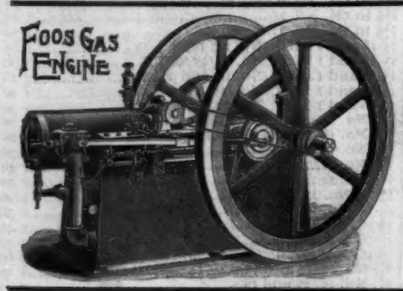
45 Broadway, New York,

MANUFACTURERS OF

HOISTING AND CONVEYING MACHINERY

For moving all kinds of material in Steam Power Stations, Factories, Gas Works. Mines, Coal Yards, etc.

Tip Cars, Wire Rope, Barrows.
INDUSTRIAL RAILWAYS.



THE FOOS GAS AND GASOLINE ENGINES.

FROM 1 TO 50 HORSE POWER.

These Engines give a regular, steady speed
Can be run with Manufactured Gas,
Natural Gas, and Gasoline.

MANUFACTURED BY THE

FOOS GAS ENGINE CO.
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Phosphate and
Hammock Lands.

EXAMINATIONS AND REPORTS MADE. Correspondence Solicited.

Moffet Portable Drill

UNSURPASSED AS A REAMER.

Weighs 48 pounds and drills from ⅜ to 2 inches diameter.

Runs with Steam or Compressed air.
Will Work in Any Position.
An Economical Substitute for Rachet Drilling.
Send for Circular.

MANUFACTURED BY

J. G. TIMOLAT
89 and 91 S. Fifth Ave., NEW YORK.

Subscribe for THE IRON TRADE REVIEW; $3.00 per year.

No. 15-17	2 05
No. 18	2 20
No. 20	2 30
No. 22-24	2 40
No. 25.26	2 50
No. 27	2 60

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 60
Shell	1 85
Flange	2 10
Marine Flange	2 35
Fire Box	3 35

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. ℔. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s.
1 to 2 in. inclusive	08
9-16 to ⅞ in. "	08½
7-16 to ⅜ and 2⅜ to 3 in	09
3⅛ to 4 in	09½
⅜ to 11-16 and 4⅛	10
⅝ to 6 in	10½
¾ to 9-32 and 6⅛ to 7 in	11
3-16 in	13

Flats.

	cts. ℔s.
2 to 9-16 in. wide by 2 to ⅝ thick	8

Bessemer and O. H. Steel.

Machinery, base price,	1 80
Tire, "	1 85
Spring, "	2 20
Sleigh Shoe, "	2 20
Toe Calk, "	2 05
Cutter Shoes, tapered and bent, "	2 45

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 70
Bridge ½, ⅝, 11-16 and ¾ inch diam	3 40

MACHINERY SUPPLY MARKET.

Anvils.

American, ℔	9@10
Wright's, ℔	12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 35
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel, ℔	3½
Iron, steel points, ℔	1b 3

Drill and Drill Sockets.

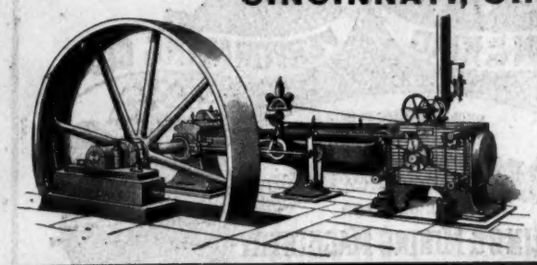
Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150 gr.	Flour, C, F, FF.
Kegs, ℔	4½c	5 c	2½c
½ kegs ℔	4¾c	5¼c	2¾c
¼ kegs ℔	5 c	5½c	3 c
10℔ cans, 10 in case	6 c	6½c	5 c
10 ℔ cans less than 10	10 c	10 c	7½c

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



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ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.

CLEVELAND ROLLING MILL CO.,

CLEVELAND, OHIO,

—MANUFACTURERS OF—

BESSEMER AND OPEN-HEARTH STEEL,

Blooms, Billets, and Slabs, Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Bar Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates, Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing

WORLD'S FAIR AWARD.-

We are the only Steel Roofing Co. awarded Medal and Diploma for **PATENT CAP ROOFING** at World's Columbian Exposition. We are also large manufacturers of all styles of METAL ROOFING, SIDING, CEILING, ETC. Send for Catalogue and Price List. Mention this paper.

SYKES IRON & STEEL ROOFING CO., - Chicago and Niles, O.

Bolt and Nut Works.

THE UPSON NUT CO., Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Steel Stamps and Stencils.

FLEHARTY, J. H. & Co., Rubber Stampes Seals, Stencils, Automatic Check Punchs, and Numbering Machines. 92 Seneca St.

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—SPECIALTIES—

Iron, Gold and Silver Mining.

Offices: { 100 W. Washington St., CHICAGO. MARQUETTE, MICH.

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	12c
" " " " over 5 lbs	10c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3½	3½
Hexagon	15½	11½	8½	6	5¼	5¼	
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ¼ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887	dis 85
Standard Penny Nails, ¼ keg card rate	
{ Car lots	$1.10
{ Less than car lots	$1.25

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ¼ doz	dis 10@10&10

FIRST MORTGAGE 15-YEAR SIX PER CENT. GOLD BONDS WITH SINKING FUND

OF THE

BLUE RIDGE IRON COMPANY

OF VIRGINIA.

BLUE RIDGE IRON COMPANY. } CONSOLIDATED.
CRESCENT IRON COMPANY. }

LILY AND CRESCENT MINES.

Dated March 31st, 1894. Due April 1st, 1909

Interest Payable April and October.

GUARANTEED TO APRIL 1st, 1899

—BY—

THE FIDELITY AND DEPOSIT COMPANY OF MARYLAND,

TRUSTEE FOR BONDHOLDERS.

Both Principal and Interest payable in Gold Coin at the office of the Trustee, Baltimore, Md.

TOTAL BONDED DEBT, $50,000.00. **CAPITAL STOCK, $300,000.00.**

GENERAL OFFICES: EQUITABLE BUILDING, BALTIMORE, MD.

Mines and Local Offices: Stanley, Page Co., Va.

Bonds Issued to Improve Mines and Increase Output.

OVER 1,000,000 TONS, ESTIMATED, HIGH-GRADE BROWN HEMATITE ORE.

N. & W. Ry. at Mines, Connecting Direct to the Great Iron and Steel Manufacturing Centres of Virginia, Pennsylvania Ohio and Maryland. For Prospectus and Description, with Expert Analysis of Ores, Address

ANDREW MAYER,

Investment Banker, 18 Wall St., NEW YORK CITY.

Packing, Steam.

Boston Belting Co	dis 60
American Packing Hemp	₱ lb 9@10
Russia " "	₱ lb 14
Italian " "	₱ lb 13@19
Plumbago Piston	₱ lb 40
Peerless	₱ lb 60
Morrison's "	₱ lb 45
Square Flax "	₱ lb 50
Sheet Rubber	₱ lb 128&24
Excelsior Rubber	₱ lb 48
Rainbow { Full Rolls	45c ₱ lb
Rainbow { Less than Full Rolls	50c ₱ lb
Eclipse Gasket	₱ lb 75

Picks.

Railroads, 5 to 6 lbs	$12 dis 60
" 6 to 7 lbs	$13 dis 60

Pulleys.

Iron Pulleys, Walker List	dis 50
Medart Pulleys	dis 50
Split Wood Pulleys	dis 55@60

Rivets.

Iron, Thousand, list November 17, 1887	dis 50&10@60
Iron, Ordinary, Cooper's Block and Carriage list November 17, 1887	dis 50&10@60
Copper	dis 50@50&10

Saws.

Disston's Circular	dis 40&10
" Band	dis 25
" Scroll	Net
Hack Saw Stubs	dis 20
" " Eureka	dis 20
" " Star	dis 20
Saw Swages Diston's	dis 30
Atkins' Circular Saws	dis 40&45
" Mill, Mulay and Drag Saws	dis 40&10
" Wood Saws	dis 40&10
" Silver Steel Diamond Cross-cut Saws	70c per ft
" Dexter Cross-cuts	50c "
" Diamond "	30c "
" Tuttle Tooth Cross-cuts	25c "
" One-man Cross-cuts	32c "
No. 1 Handles	23c per pair
No. 6 "	16c "
Excelsior Saw Tools	$6 per doz
Derfection "	$15 "
Petroit Saw Works, Circular	dis 50
" " " Band	dis 25
" " " Mulay	dis 45

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 30

Wire.

New List, Apr. 9, 1894

Brass	dis 40
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ₱ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7.45 am	†11.55 am
Pittsburgh, Bellaire and East	†12.45 pm	† 6.25 pm
Philadelphia and New York	* 1.40 pm	*11.15 am
Baltimore and Washington	* 1.40 pm	*11.15 am
Alliance and Pittsburgh	* 1.40 pm	*11.15 am
Ravenna and Alliance	† 3.25 pm	† 9.50 am
Hudson and Ravenna	* 5.10 pm	* 8.15 am
Philadelphia and New York	*11.10 pm	* 5.25 am
Baltimore and Washington	*11.10 pm	* 5.25 am
Alliance and Pittsburgh	*11.10 pm	* 5.25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8.40 am	* 5.15 pm
Akron, Columbus & Zanesville	†12.45 am	*11.55 pm
Akron and Columbus	* 2.40 pm	*5.15 pm
Akron and Orrville	† 3.25 pm	† 9.50 am
Columbus and Cincinnati	* 8.00 pm	* 7.00 am

STEEL, IRON, COPPER, ZINC, BRASS, TIN,

And all Other Metals Perforated as Required for

GRAIN CLEANING AND MINING MACHINERY,
WOOLEN, COTTON, PAPER AND PULP MILLS,
RICE, FLOUR AND COTTON SEED OIL MILLS,
SUGAR AND MALT HOUSES, DISTILLERIES, FILTER PRESSES,
STONE, COAL AND ORE SCREENS,
BRICK AND TILE WORKS, FILTERS,
SPARK ARRESTERS, GAS AND WATER WORKS,
OIL, GAS AND VAPOR STOVES,
COFFER MACHINERY, ETC., ETC.

STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

THE HARRINGTON & KING PERF. CO.,

Main Office and Works, 222 to 240 N. Union St., Chicago, Ill., U. S. A.

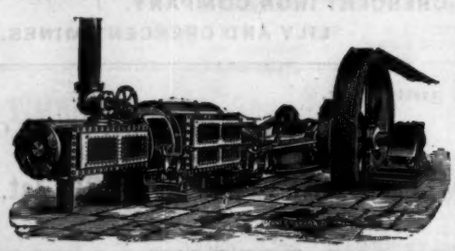
Eastern Office, No. 284 Pearl St., New York.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

THE PORTER-HAMILTON ENGINE

SINGLE, COMPOUND & CONDENSING



Blowing Engines.
Hydraulic Cranes and Accumulators.
Heavy Special Machinery.

ENGINE CATALOGUE ON APPLICATION

THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

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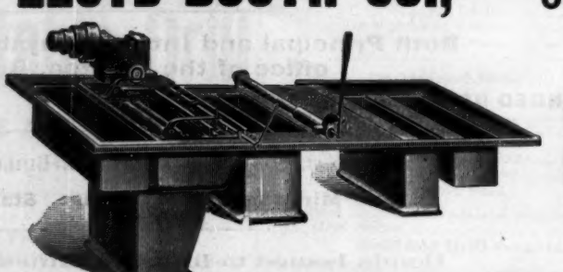

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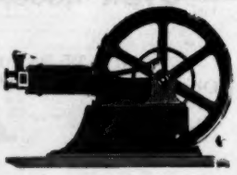

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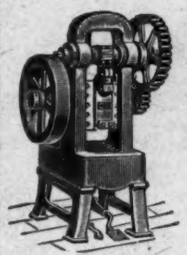

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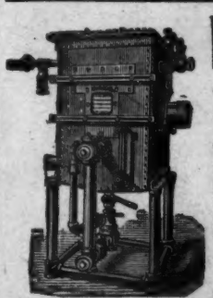

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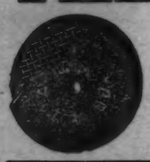

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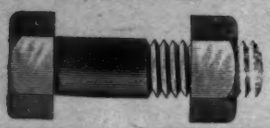

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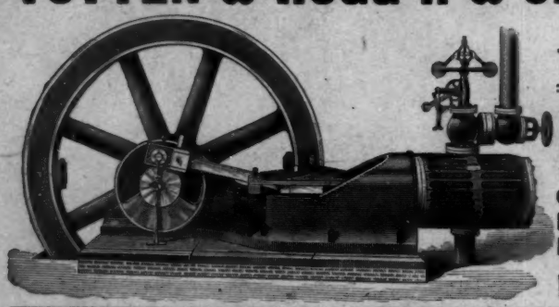

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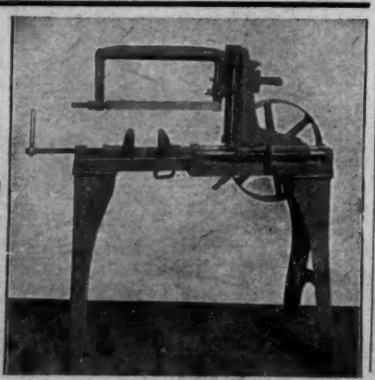

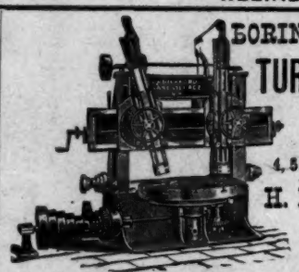

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